People's Democratic Republic of Algeria
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Larbi Ben M'hidi University, Oum El Bouaghi.

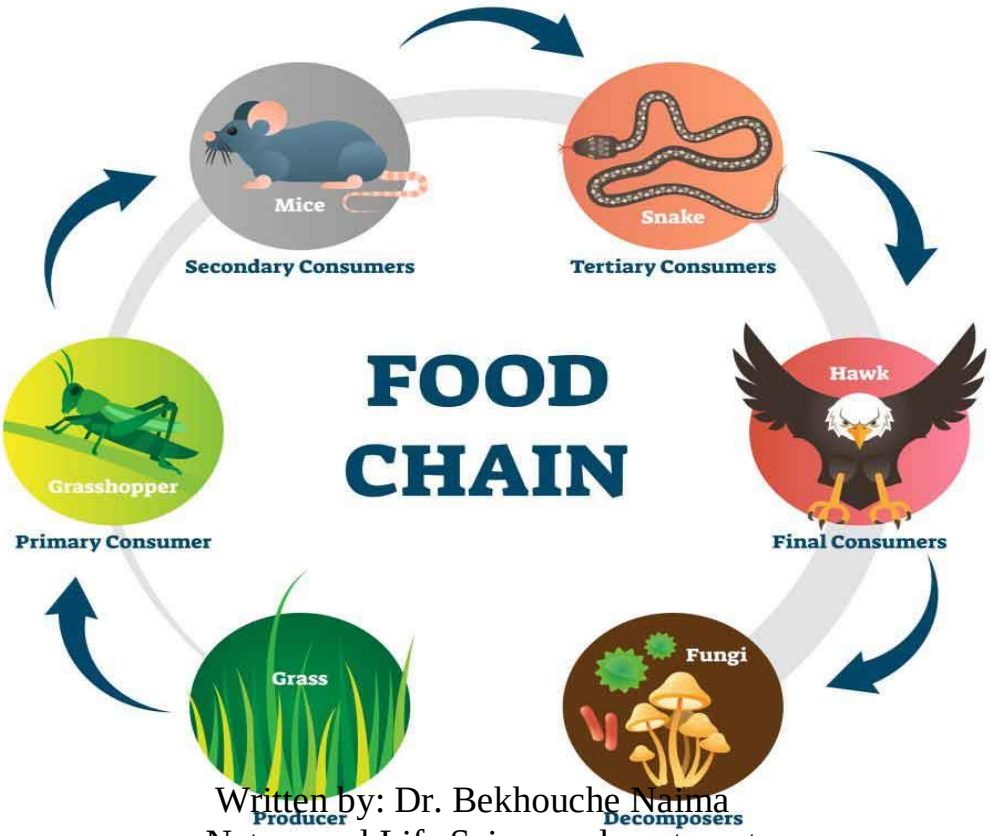
Faculty of Exact Sciences, Natural and Life Sciences
Nature and Life Sciences department

Handout of TD

Subject: General ecology

Teaching intended for students in the second year of Preparatory

Classes for Natural and Life Sciences



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Introduction

It is my pleasure to present to the dear students at the university level, along with all researchers and those interested in the subject of the environment, the fruit of the modest effort represented by this publication, which is the juice of scientific experience that extends for more than ten years in teaching this university course.The study of ecology and the problems associated with it and mastering its understanding and awareness towards it , has become necessary for the university student, as he is the strongest candidate to lead the environmental awareness process in society, so this work represents an attempt to understand and convince the reader , whether a university student or not, of the fundamental importance of the environment and the greatness of the services it provides to all humanity on the one hand and the seriousness of the problems we cause to it on the other hand. Our publication includes a collection of intensive directed works to help the student. It deals with the most important basics of ecology, not all of them, due to the lack of time allocated for the second semester. We have presented most of them extensively, in answer to questions, and we left the details and expansion of the enrichment of the material for the student's self-readings. In the latest publication, we have proven the references that we have adopted in its preparation, and we believe that they are useful for enriching his information. Immediately after this introduction, the student learns about ecology : its concept, what it studies, its importance at the moment, and its relationship with other sciences. He will know why we care about the environment and the need to preserve it. He will be well acquainted with the meaning and concept of the environment, its components, and its divisions. It learns about the environment of groups, what they mean, their concept. To complete the topics of ecology and group ecology, the student will learn about the biosphere, the " environment of life" and its living and non-living components, and biogeochemical cycles. The natural, permanent, renewable and non-renewable resources of the environment, and in connection with the last task (sustainability of natural resources), the student will learn about the ecosystem, the biosynthesis of natural ecosystems, living organisms, food cycles and relationships . He will also learn about environmental factors, their living and living divisions, including : heat, light, water, soil and its components, in addition to the determining factors, and endurance levels. Each guided work of this publication ends with a series of questions of various styles in the form of calendars, the purpose of which is to renew the mindset of the student – or the reader in general – and to stimulate the desire for discussion and recall and review of topics. This question paragraph is very important to gauge the student's level of understanding and comprehension of the content of the topics presented. Of course, such topics continue to raise more scientific questions than those listed here. I hope that my share of this publication will be for the university library and its students. My hope is that it will be a modest scientific addition that will improve its degrees for the benefit of all people.

TD 01 : Basic Principles in Ecology

The expression (interrelationships) between organisms and their environment is the pivot around which the definition of ecology revolves and we have to understand these relationships. Therefore, we must have extensive information about both the organism itself and the environment in which it inhabits. We must know something about the classification, composition and food of the organism and

know in a comprehensive manner the nature of both living and non-living environmental factors related to the organism, at least those that affect it.

Activity 01

To understand this, note Document 1 : On National Geographic Channel, a documentary screening of various live media :

For the purpose of distinguishing between the living elements and the abiotic elements that make up the living environment, use the document.

1- Extract from Document 1 the constituent elements of this living medium (living and abiotic elements).
2- Identify what the living elements collectively make up in the neighborhood.
3- Identify what the abiotic elements collectively form in the neighborhood
4- Introduce the neighborhood.

1- Living elements : camels, elephants, deer, turtles, fish, trees, grasses, coral

Abiotic elements : sand, soil, mountains, water.

Through the previous application, we conclude the following :

The living medium : It is a group of organisms that interact with each other and with the sum of the elements of the medium.

Living environment = unit of life + geographical range

Living elements : (Biocénose) : Represented in all living organisms, characterized by their vital functions such as : reproduction, excretion, breathing ...

Biotope: It does not perform the vital functions of water, soil andclimate (heat. Flashlight.

Activity 02

We mentioned that the medium consists of living elements (living organisms) and non-living elements (the five physicochemical factors of the biogeographic range), where the relationships between living organisms are linked, the most important of which are food relations, while abiotic factors are those that provide food from productive organisms (plants). As a result of these different factors, the media are different and therefore there is a great diversity of living organisms.

The stability and persistence of the living medium as a result of the balance between these relations is the prerequisite for the formation of what is known as the ecosystem.

- What is an ecosystem ?
- And how are ecosystems diverse ?

➢ **Ecosystem**

So that we can conceptualize the ecosystem. We try to identify the necessary conditions for the installation of a miniature ecosystem such as a swamp.

Read the following scientific text :

"The rain finally fell to quench the earth's thirst. He asked through waterwheels and streams until he settled in a low place among the rocks among the rocks, forming a small pond. The leaves of the trees

began to fall on this pond, and the water-loving hopper came to feed on it, so it multiplied quickly until it invaded most of the pond, but the coming of the dragonfly, which likes to eat the hopper greedily, prevented the increase in its number, and this made the dragonfly in turn multiply quickly until the appearance of the frog, which took shelter in this place to live at the expense of the dragonfly, which was an opportunity for the growth of the snake to feed on the frog. In order not to reproduce, she in turn had the falcon with the lookout, which settled near the pond, which gradually turned into a swamp full of various organisms : aquatic plants – plankton – aquatic insects (Document 02).

Document 02 : Swamp

Through this scientific text, we note the following :

- The medium formed is a swamp-type aquatic medium.
- The conditions for the installation of a swamp ecosystem are as follows :

The presence of special organisms that have food relations in the form of a parallel food network.

This medium is in a state of internal stability in the sense that this balance is not disturbed by the intervention of strange external factors

All five abiotic elements provide: water in which plants, aquatic insects and plankton swim – air that provides oxygen and coal gas – soil that feeds aquatic plants and phytoplankton – moderate heat – sufficient light.

Taken together, these conditions define what is known as the ecosystem.

Accordingly, the ecosystem can be defined as follows :

Ecosystem : It is the set of organisms and the physical and chemical factors of the medium that are linked by a network of relationships that form a balanced and stable ecological unit."

- **Diversity of ecosystems**

The globe, with its seas, oceans, atmosphere, vegetation and animals, is a large ecosystem.

The land, with its terrain and climatic regions that differ in temperature, soil nature, lighting and moisture, makes it a diverse ecosystem.

(Document 3) shows : Ecological systems on land

Document 03 : Various onshore ecosystems

Terrestrial ecosystems are ecosystems that rely solely on land. There are different types of terrestrial ecosystems distributed in different geological regions, which are as follows :

- Forest ecosystems, where this system consists of many plants, animals and microorganisms that live in coordination with the abiotic factors of the environment, and forests also help to maintain the Earth's temperature and are the main source of carbon.
- Grassland ecosystems in this system, grasses and grasses dominate the vegetation, and temperate grasslands and savannah grasslands are some examples of grassland ecosystems.
- Tundra ecosystems where tundra ecosystems are devoid of trees and are found in cold climates or where precipitation is scarce, such as the arctic ecosystem or mountain peaks, is a type of tundra.
- Desert ecosystem where deserts are located all over the world and these are few rainfall areas, the day is hot and the nights are cold (Document 04) : Aquatic Ecosystems

Document 04 : Various Environmental Systems

Aquatic ecosystems are ecosystems that exist in a water body and can be divided into two types :

- A freshwater ecosystem A freshwater ecosystem is an aquatic ecosystem that includes lakes, ponds, rivers, streams, and wetlands and does not contain salinity unlike a marine ecosystem.

- The marine ecosystem and the marine ecosystem are the seas and oceans, and these systems contain a high degree of salinity and biodiversity compared to the freshwater ecosystem.
  We can also find inside these ecosystems infinitesimal systems such as the tree trunk, which can consist of the following organisms : termites that feed on tree sap – woodpeckers that feed on termites...

Some Ecosystem-specific Terminology

1. **Ecology :**
   It is the study of the relationship of living organisms to their external surroundings, and ecology literally means the study of the organism in its habitat. The term ecology was coined by the German scientist Haeckel (1869) and is a compound of two words (Oikos) meaning house andLogy meaning science. This scientist was concerned with studying the relationship of the organism to its organic environment and inorganic environment. Ecology is divided into two parts :
   - Animal Ecology : It is the relationship of animals to their surroundings (Environment).
   - Plant Ecology : It is the relationship of plants to their surroundings.
2. **Definition of Surrounding Environment**
   It is clear from the definition of ecology that there are two basic elements that are the object and the environment and one affects the other, that is, the effect is mutual. The environment can be broken down into four main components, which can be individually identified and analyzed. These components are :
   1-Weather
   2. Food
   3-Animals and other disease-causing organisms.
   4-Place of living.
   These four components are further divided, for example, weather components can be heat, humidity, and possibly light. Food has several aspects, some of which are more functional than environmental. Animals and other organisms include different types. They also include viruses, spores and pathogenic fungi. The living space represents the environment and is valuable because it helps in understanding the diverse interactions between the diverse components of the environment.
3. **Population :** It is a group of individuals that belong to one type of living organism such as humans, deer, camels, brown fish, and others.
4. **Community :** A number of Populations living in a particular area that are compatible and coexisting with each other.
5. **Ecosphere :** It includes all living organisms on the Earth's surface that deal with the natural environment.
6. **Biosphere :** It includes land including soil to a depth of up to 2 km and includes the lower part of the atmosphere and oceans.
7. **Habitat**
   Is where the organism lives and influences it. It is that part or space surrounding the organism that may be similar to the conditions surrounding the organism. This space may be different in size, starting from micro-environments such as tree trunks, and it may be large environments such as deserts and oceans for some organisms.
8. **Biota :**
   It is a term given to two groups of organisms, the Fauna and the Flora, in a given area.
9. **Niche**
   It is the special environment of the animal that occupies it in the biosphere and its relationship to food and enemies. It is the position that this organism is characterized by within its society and ecosystem, or in other words its functional status. This situation results from its structural

adaptation, physiological characteristics and its own behavior, whether this behavior is genetic or acquired. This concept was first created and developed by Elton in 1977.

The ecological nest for any living organism is not only related to the place where this organism lives, but also to the work it does in this place (biologically, of course).

In other words, we can say that the dwelling is the " address of the organism " or "its place of residence ", while the ecological nest is its " job" or "profession " within the group of species with which it lives in the biological community.

10. Autecology

It is concerned with studying the needs of the individual and his interaction with the environment and the impact of the environment on him (a close relationship with the habitat) such as the human environment, the environment of oak trees, or the environment of colon bacteria.

11. **Synecology :**

It is the science that is concerned with studying the environment of each of the organisms that include plant or animal species, taking into account the overlap and correlation between different groups within a particular area (for example, the marsh environment, the lake environment, the forest environment, the mountain environment, or the river environment.

12. Ecosystem

It is the complex structure formed by the presence of plants and animals (Biota) together within the community affected by all the intertwining factors of the living and non-living environment surrounding it.The concept of ecosystem as defined by Tansili in 1935 refers to the combination of the two aspects (organisms and the environment) into one unified entity that embodies the depth of relationships between neighborhoods and the set of influential environmental surrounding conditions. In 1929, Vernadsky defined the concept of ecosystem as the space or scope that includes the life system of the planet Earth. Beginning in 1950, the concept of ecosystem took on a greater and deeper dimension and meaning as a result of scientists' mastery of the study of the movement and direction of the flow of energy and the circulation of materials between ecosystem organisms that can be classified from the angle of their functions into: producing organisms, consuming organisms and decaying organisms. The concept of ecosystem has come to refer to the integrated ecological unit that consists of living organisms and non-living components in a specific place that interact with each other in a precise and balanced system and continue to play their role in the continuity of life.

13. Types of ecosystems

- On the one hand, the availability of living and non-living components :

- **An integrated ecosystem** : sometimes called an open ecosystem and it contains all the basic components (living and non-living), for example : a lake or river that contains :
- **Abiotic factors**: water, carbon dioxide, oxygen, nitrogen. –
- **Biotic factors**: such as products, plants with roots, or floating plants found in the illuminated area to carry out photosynthesis.
- **Consumables :** such as insects, small and large fish.
- **Decomposers** : At the bottom of the lake such as bacteria and fungi (the bottom of the lake accumulates the remnants of plants and animals).

- **Non-integrated ecosystem**: It is called a closed ecosystem and it often lacks one or more of the basic components such as the abyssal depths of the seas or closed caves, where we do not exist there as a product of not providing solar energy.

14. **Ecosystem concentrators**

14.1Abiotic Factors :

It is defined as a set of non-living factors that have an impact on the life of living organisms. These factors can determine the quality of these organisms and their whereabouts, as well as determine the type of relationship between these organisms. Scientists divided these natural factors into three main types :

- **Weather factors :** These factors include light, heat, humidity, wind, gases, and pressure.
- **Soil factors:** They include the components of the soil, its location, the percentage of moisture contained in the soil, its types, whether it is organic or inorganic soil, and soil factors have an important role in determining the type of organisms that live in or on it.
- **Aquatic factors :** These include freshwater, saltwater in aquatic environments, as well as water content in land areas.

14.2 Biotic Factors :

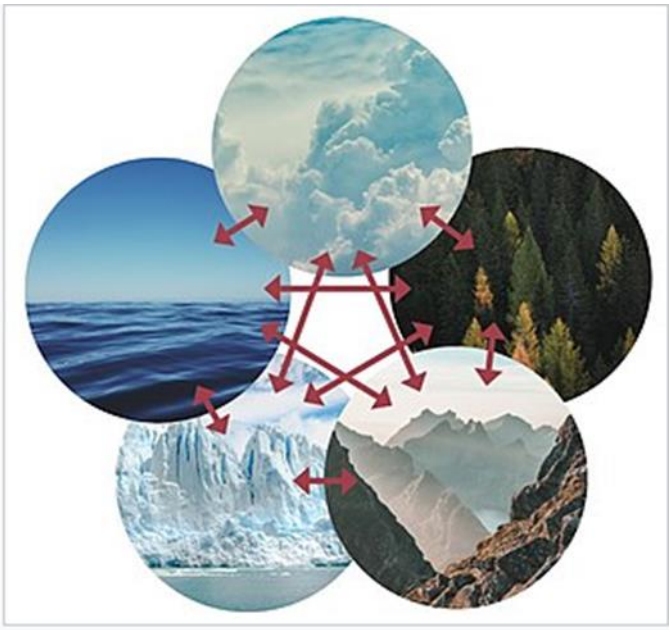
It is all the organisms in the ecosystem. This includes many different species of humans, animals, plants, and microorganisms. The term "biological community" refers to a group of organisms that live in an ecosystem and are related to each other in reciprocal relationships. For example, a lake ecosystem is a group of organisms that live in the lake and relate to each other in food relations. This is called a biological community. They are the living elements produced, such as all plant organisms, which make their own food by many non-living elements.

15. **Components of the climate envelope**

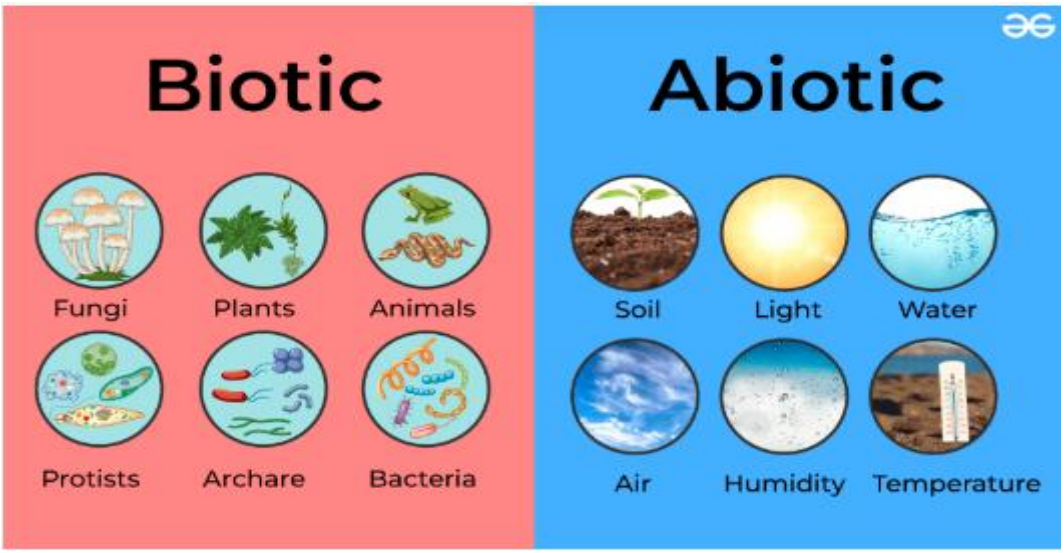
(Document 05) shows how all five components of the climate system interact.

Earth's climate arises from the interaction of five key components of the climate system :

(atmosphere(air), hydrosphere (water), cryosphere (ice and permafrost), lithosphere(Earth's upper rock layer), biosphere (living organisms



Document 05 : All five components of the climate system



Document 06 : Living and Abiotic Environmental Factors

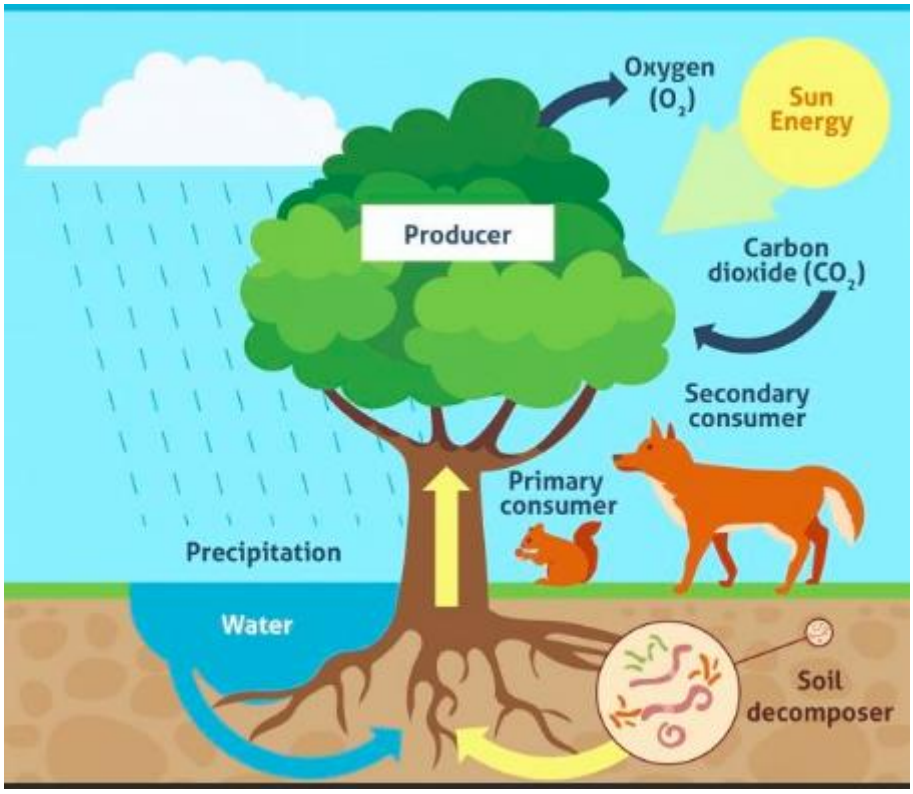
16. Environmental factors affect organisms in different ways :

1- By excluding some species from a region where some chemical, physical and climatic factors are not suitable for these species and thus affect the geographical distribution of these species.

2- By changing the fertility and mortality rate of some species, environmental factors also affect the cycle of development, slowing it down or accelerating it and causing migrations, so they affect the abundance (density) of groups (population).

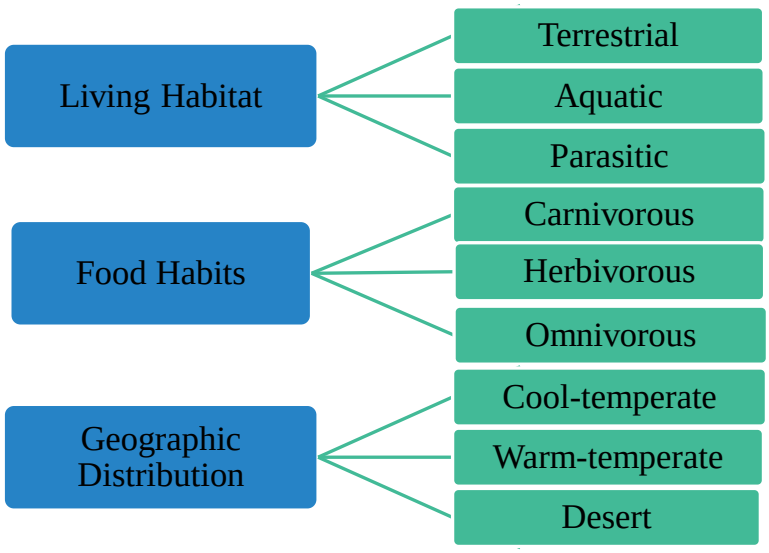
3- By the emergence of some adaptive changes such as adjusting the amount of metabolism and entering the phase of dormancy, hibernation, and summer inactivity, as well as reactions to the photoperiod.

Document 07 : Various Levels of Regulation in the Ecosystem



Document 08 : Interactions between ecosystem components (biotic and abiotic)

- **Animals are classified in environmental terms into several sections according to ecological habitats, food habits and geographical distribution as follows :**



Document 09 : Classification of Animals according to Environmental Habitats and Dietary Habits

Reinforcement

Question 1 : Write the scientific term that represents each of the following definitions ?

1. A specialized branch of science that studies the interrelationships between organisms and their interactions with their environments
2 The space in which the organism lives.
3. Living components in an organism's environment.
4. A group of organisms of the same species living and reproducing in the same place at the same time.
5. A model representing diverse straddling food chains and pathways in which energy travels through populations of organisms.
6 A chemical that an organism must obtain from its environment to carry out its vital processes and continue its life.

Question 2 : Choose the correct answer from each of the following :

- 1 The presence of organisms that mate with each other in one place at a time called :
Ecology - Biological Community – Ecosystem –
2- Among the non-living factors in the zebra environment :
Algae. Plants - Fish - Temperature
3-The simplest levels of environmental regulation :
Organism - Community - Community - Ecosystem
4. A specialized branch of science that studies the interrelationships between living organisms and their environmental interactions :
Biological Community - Ecology - Observation - Ecosystem
5-Any of the following levels of organization includes all other levels :
Ecosystem - Biological Community - Biological Community - Individual
6-Part of the globe supports life :
Biocommunity - Biosphere - Ecosystem - Organism
7-The area in which the organism lives :
Habitat
8-The appropriate term to describe the role of the ant in collecting food :
Predator - Environmental space - Parasite - Environmental habitat
9-Living organisms that feed on plants and animals :
Herbal Eaters - Meat Eaters - Various Nutritious Organisms - Analyzers
10-The relationship between clownfish and anemones is a relationship :
Coexistence - mutual benefit - intrusion - predation

Question 3 : Explanations for the following :

1- Ecologists monitor living organisms ?
2. Interactions between organisms in the environment are important ?

TD 02 : Laws of Endurance and Determinants

The distribution and spread of living organisms in the Earth is affected by the nature of their tolerance to natural climatic changes in general, which includes a number of factors such as heat, humidity, light, wind, the nature of the soil, the quality of the organisms in that area and other factors. On this basis, the patterns of abundance and spread of plant, animal or other life groups can be understood.
Living organisms grow, reproduce and spread in their environment when appropriate environmental factors are available. If a factor is disrupted, it negatively affects one of their activities. This factor is called the determinant factor, and it may be one or more factors.

1. Limiting factor

Activity 01

We grow the tomato plant in a greenhouse in varying conditions of CO 2concentration and luminous intensity. Every 5 days we measure biomass (amount of dry matter) experimental conditions and the results are represented in the following table :

The experiment	Conditions		Productivity after a month (nominal unit)
	Lighting (Lux)	Co_2 concentration (nominal unit)	
1	16140	1000	7
2	5380	1000	5
3	16140	400	3.8
4	5380	400	3.5

1- Why do farmers resort to farming in greenhouses ?
2- Analyze the results of the table
3- In which trial is 2COthe determining factor ? In which experiment is the light intensity the determining factor ?
4- Extract the concept of the limiting factor ?

Solution :

1- Farmers resort to agriculture in greenhouses in order to control climatic factors and thus control the increase in productivity
2- Curve analysis: The document represents the biomass (amount of dry matter) of the tomato plant grown in a greenhouse in variable conditions of CO2 concentration and lighting intensity where we note:

In ideal conditions of concentration of $_{2CO}$ and luminous intensity (16140 Lux, 1000 W.E.) the amount of dry matter is
Productivity (significant when one or both factors are lacking) Concentration$_{2\ CO}$ Light intensity (the amount of dry matter decreases.

3- 2CO is the determinant in Trial 3. The luminous intensity is the limiting factor in Experiment
4- The concept of the determinant factor : It is the factor close to its minimum and determines productivity.

Activity 02

Note Document (01) :

- Silica in Iraqi inland waters is available in sufficient quantities to grow the diatoms it needs to grow and continue its life as it forms the basis of its cell wall structure, while silica is one of the determinants of productivity in a number of British lakes for some types of diatoms.
- Likewise, phosphates in marine waters have a specific role that regulates the abundance and abundance of plankton and thus affects the productivity of these marine waters.

Document 01 : Pictures of diatoms (left) and plankton (right)

Result : Concept of Determinant Factor

All organisms in the environment in which they live are subject to the combined influence of climatic factors, soil factors and various biological factors, and the term environmental factors refers to the elements of the environment that can directly affect organisms at least at some stage of their development.

The concept of determinant applies to all environmental factors, both for their lower limits and for their upper limits. Thus, each living organism has a tolerance to environmental factors, between which lies the optimal environment for the animal. The determinants of growth vary with organisms and the habitat of those organisms.

An environmental factor is a determinant when it is :

1- This factor is missing.
2- or when it dwindles below the necessary minimum.
3- or even when it exceeds the upper limit allowed

2. Stamina Laws

2.1 Low of minimum law

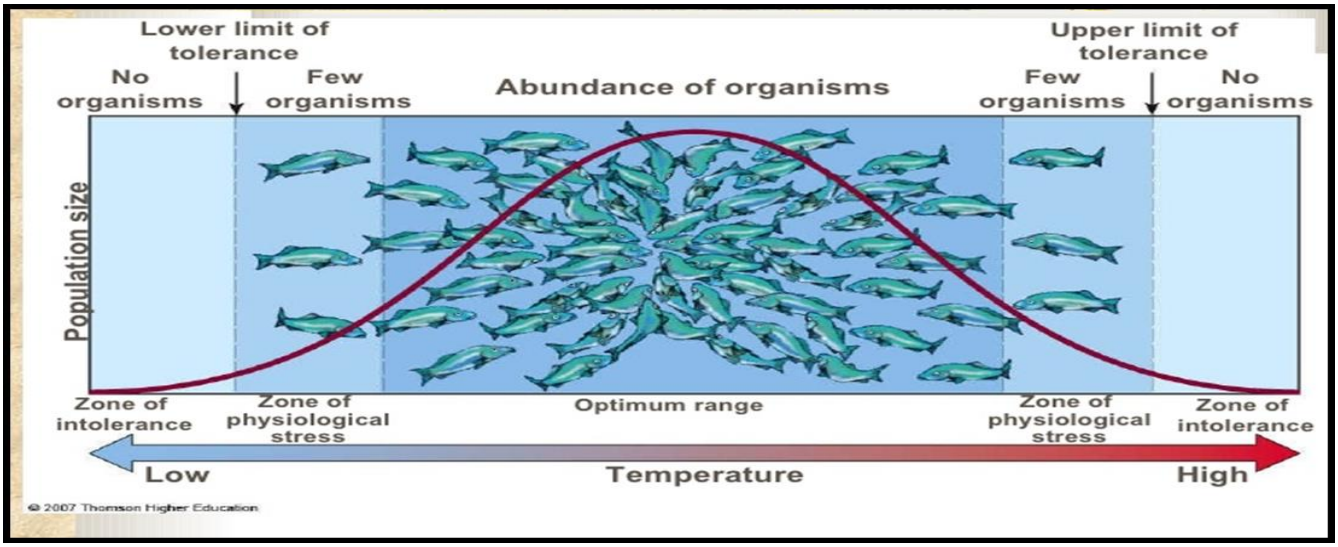
Liebig's law states that the basic materials available in the habitat of the organism in very small quantities approximate the critical minimum necessary for the life and growth of the organism and are the determining factor for that type of organism. Therefore, Liebig's law is called the Low of Minimum Law.

2.2 Law of Optimum

In 1897, the scientist Wollny introduced an amendment to the law of the minimum, where he found that the increase of the determinant factor from the critical minimums leads to an increase in the growth and activity of the organism, but not in a fixed linear form, but to a certain value called the maximum value, after which production gradually decreases. The value of the environmental factor at the maximum growth value is called the optimal value of growth (Optimal value).

2.3 Law of maximum or law of tolerance

This law was introduced by Shelford in 1913, who observed that just as there is a minimum value for a particular environmental factor at which the growth and activity of an organism stops, there is also a maximum value beyond which the organism is inactive. In front of you, document (02), analyze and what do you conclude ?



Document 02 : General Act of Endurance for the Shelford World

Result :

a- The animal dies if the temperature is too high and too low (no living organisms).

b- When the heat approaches these limits, the animal suffers from high heat or cold (Coma suffers from high heat or low temperature coma).

c- Their vitality decreases and they become scarce in media where heat near tolerable limits (rare organisms) dominate.

d- The animal becomes more abundant and abundant as the temperature of the medium approaches the mean values that form the optimal temperature for this animal (many living organisms), and this example can apply to all other factors.

✓ The field of activity of the organism between the lower and upper values is called the tolerance interval, which is a field related to several factors and it is impossible for the organism to be active outside it.

✓ The optimal field of living varies according to the types of living organisms and according to the nature of the environmental factor, and also varies according to place and time.

2.4 Optimal value

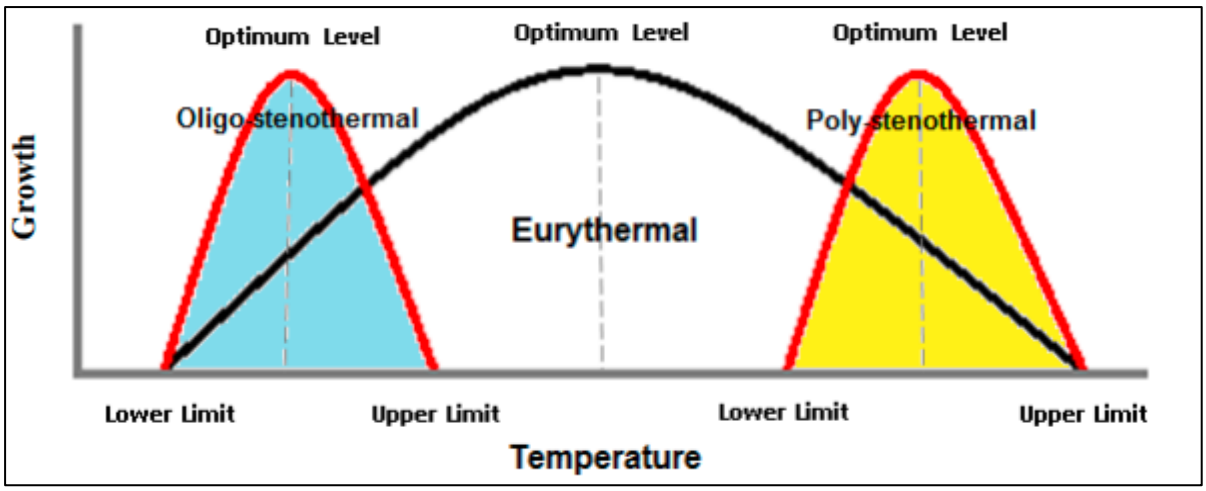
It is a value of the environmental factor that belongs to the optimal field of living, at which the activity of the organism is maximized. This value varies from one organism to another and from one environmental factor to another, and it also varies according to the place and time of the same organism and the same environmental factor.

2.5 Basic Concepts in Endurance Law Applications.

- Organisms that have a wide tolerance to most environmental factors are those that are more widespread in nature and more likely to survive.
- Some organisms have a wide tolerance to some environmental factors and a narrow tolerance to some other factors.
- The lack of a quantity or a factor in nature negatively or positively affects the tolerance of another element.
- The tolerance of an environmental factor often changes spatially and temporally.

1. Environmental Equivalence :

The environmental equivalence of a species is the potential that this species has for living in different environments characterized by significant changes in environmental factors. Therefore, we find document (03) analyzed and what it concludes :



Document 03 : Environmental Capacity

Result :

Ecological valence

Ecological capacity can be defined as the extent to which an organism tolerates changes in abiotic environmental factors, which are divided into three sections :

1- A species with poor environmental parity can withstand only limited changes in environmental factors and is called Stenoeco.
2- A species with high environmental equivalence is one that is able to live in very different or very variable environments and is widely called Euryeco.
3- Mesoeco organisms are organisms that have an average tolerance range for the environmental factor.

At the lower and upper limits or levels, the organism experiences a physiological tension or effort to counteract those extreme levels of the environmental factor.

Ecological equivalence can change at the same species depending on its stage of development. In the marine environment, the adult ***Littorina*** cochlea lives at the top of the shore and endures long periods of drought every day. As for the caterpillar that lives with wanderers, it lives a completely free life.

For example, if we take temperature, water, food and salinity as environmental factors, organisms can be described according to their range of tolerance as follows :

Environmental Factor	**Euryoecious**	**Heavy Duty**	**Mesoecious**	**Stenoecious**
Temperature	Eurythermal		Mesothermal	Stenothermal
Water	Euryhydric		Mesohydric	Stenohydric
Food	Euryphagic		Mesophagic	Stenophagic
Salinity	Euryhalic		Mesohalic	Stenohalic

Calendar

<u>Application</u> : Example study of the distribution of the scarlet insect :

This insect is one of the parasites that parasitize fruit trees. Table 1 represents its areas of tolerance and optimal living according to humidity and temperature factors.

Temperature (0C)		Humidity		
Max.	Min.	Max.	Min.	
40	2	100	01	Stamina Range
35	20	75	55	The optimum living space

Table 2 : represents the climatic conditions of two stations (Oujda and Saïdia) located in the northeastern region of Morocco.

Al-Mahatta	Months	Jahnvi.	Feb	March	Avrile	May	June	July	August	September	Oct	November	December
Oujda	Temperature °c	10	11	13	15	20	25	30	35	25	20	15	15
	%MOST	30	30	35	30	40	20	10	08	10	10	15	20
Saidia	Temperature °c	10	12	14	15	16	20	25	30	28	27	20	15
	%MOST	80	70	60	55	40	45	55	60	70	75	75	80

1- **Based on** the data of Table 2, it **was completed** on the same landmark, the climate plan for the Saidiya and Oujda stations, i.e. temperature and humidity changes according to the months of the year.
2 Determine the areas of tolerance and optimal living for the scarlet insect (climate environmental plan).
3 By **exploiting** the obtained environmental-climatic scheme, **extract** the plant that provides the appropriate conditions for the scarlet insect ?

TD03 : Impact of climatic factors on the distribution of organisms

We mentioned that the various factors of the biogeographic extent are the reason for the diversity of living organisms through different media, but we note that their distribution in one medium is not random. We cannot find soil worms living on trees, ferns growing in bright places, dense plants in dry media, or vice versa .....Meaning that living organisms exist within the same environment in a shelter or dwelling in a controlled manner as a result of the factors of the biogeographic range that affect them positively in the case of appropriate conditions and negatively in the case of inappropriate conditions:

How do these factors affect the distribution and activity of these organisms ?

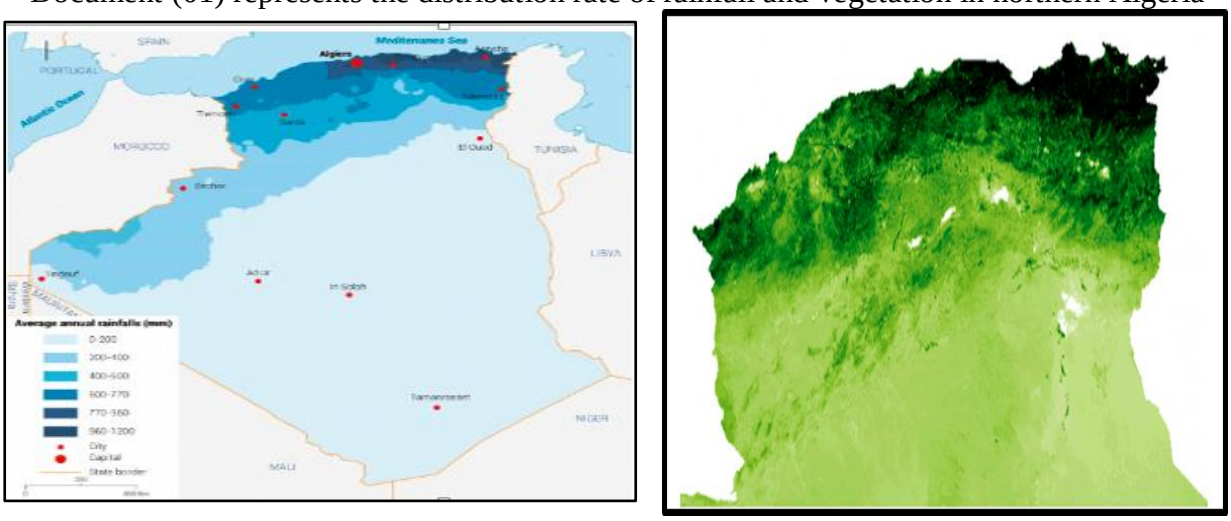
How do these organisms resist the unfavorable conditions of these factors ?

Activity 01 : The Water Effect

Water is the most widespread in the globe, as it exists in the form of water bodies that occupy two-thirds of the Earth's area, and it is also found in the soil, the earth, the air, and in the bodies of living organisms in different proportions.

How does water affect the distribution of organisms in different media ?

Document (01) represents the distribution rate of rainfall and vegetation in northern Algeria



Document 01 : Map of rainfall and vegetation distribution in Algeria

Plants are very dense in the north and decrease as we go south. When comparing the areas of water presence and the density of plants, we note that there is a match between a map of rainfall distribution and a map of the distribution of vegetation cover so that the greater the percentage of rainfall, the greater the density of vegetation.

On the other hand, Figure (1) of document (02) shows an African region that was hit by drought, so the plants died and the effects of life were removed from this medium, while Figure (2) shows the recovery of vegetation cover as a result of the abundance of water.

Document (02) : The impact of drought and water availability

Document (03) represents the effect of moisture on the distribution of organisms such as insects. The cricket prefers wet and warm places, and the lizard prefers hot and dry places.

Document (03) : The impact of moisture and drought on the distribution of animals

The following table shows the percentage of water in the composition of animal and plant organisms, soil and air in the forest living environment :

Components	Plant organisms	animal organisms	Soil	Air.
Water Ratio	80	70	40	50

Result : Water is an essential element in the structure of living media, as it controls the existence and distribution of living organisms in these media, it is a prerequisite for the establishment of any biological system

<u>Activity 02</u> : The Impact of Salinity on Aquatic Animals :

Eurysaline animals are generally the fewest in the aquatic environment, and Stenosaline animals are the majority. Animals that live in freshwater are very different from those that live in marine waters. Salinity is the determining factor in the distribution of these animals in their various aquatic media. It also determines their vital activities. For example, ***Mugil auratus*** can live in oligosaline waters such as estuaries (30-32 g/ liter of dissolved salts), but it cannot reproduce in them, as it moves to less salty waters.

Examples of the impact of salinity on aquatic animals :

Document 04 : Eel (right) and salmon (left)

Example 1 : *Anguilla anguilla* fish

The eel or snakefish is a fish that changes its environment in order to reproduce, as this type of fish usually lives in fresh river waters where the salinity is less than 0.5 g/ l. Upon sexual maturity, the fish leave the river water and migrate to the Sargasso Sea in Central America, where the salinity is 35 g/ l for the purpose of reproduction. Adult fish are likely to die quickly after laying eggs. After hatching, the young fish move and ascend to the rivers from which their ancestors came. Adult fish that move into the sea to reproduce are called sea-loving.

Example 2 : Salmon fish (*Salmo salar*) :

It is also a species of fish that changes its environment for the purpose of reproduction. Salmon live in marine waters where salinity is 35g/ L, and at sexual maturity they move to freshwater where they climb into rivers for the purpose of reproduction (laying eggs) and the young have a shape different from that of adult individuals. Adult individuals often die in places where eggs are laid because they have depleted their body energy, but sometimes some of these individuals return to the sea. Scientific studies have proven that salmon migrate to the rivers in which they were born to lay their eggs. Physiological (functional) studies have confirmed that salmon have the means and capabilities to identify and find the river in which they were born through very accurate sensory perceptions of the physical and chemical qualities of water.

One of the studies conducted on aquatic animals that have the ability to live in marine waters and fresh water, that is, move from an environmental medium to another environmental medium that is different from it in order to reproduce, is suffering a physiological shock that does not last long. These animal species, especially fish, are very few.

Activity 03 : The Effect of Lighting and Heat

The sun is the source of light and heat together, so they are two factors related to each other, and since the fall of sunlight on the surface of the earth varies according to latitudes, its intensity is affected by the relationship of the geographical location of the center to latitudes. Sunlight is perpendicular to the equator, so the intensity of light and heat is high there. It is tilted as we move away from it and accordingly the intensity of lighting and heat decreases.

1- Sunflower is a plant that loves intense lighting to the point that its flowers are always oriented towards the sun and lean with it.

Document (05) shows the effect of the degree of lighting on the growth of sunflowers where they are almost wilted in the shade area

Document (05) : The effect of lighting on the growth of sunflower plant

2- Bedbugs live in the dark inside the cracks near the human bed to feed on their blood at night and when the light is lit, they flee and disappear inside the bedding and cracks. The termites (bar) are present during the day inside the laurel to activate the Document (06).

Document (06) : The impact of lighting on animal activity

Result

The intensity of lighting affects the distribution of plants because it is an essential element in photosynthesis. Animals do not like light and live in the dark. Like light, the intensity of heat changes and interferes with the distribution of organisms so that they activate, grow and reproduce at moderate temperatures.

Activity 04 : The Air Factor Effect

- What is the benefit of air for living organisms ?
- The following table shows the gases that make up dry air and their proportions as follows :

Dry Air	
Azote (N_2)	78.1%
Oxygène (O_2)	20.9%
Carbon dioxide (CO_2)	0.035%
Other Gases	0.965%

Nitrogen with a very high percentage (78%): It plays a role in the formation of nitrate salts in the soil through special bacteria that stabilize it in the form of nitrates.

Oxygen at 21%: It comes from green plants that release it during photosynthesis, as various organisms need it for the medium during breathing processes.

Activity 05 : How Does Wind Affect Plants ?

The image of the Document (07) shows how strong winds affect the growth of the cypress tree as it grows inclined in the direction of the wind

Cypress trees with large fruits have a shape that appears to be exposed to the wind, but they retain this shape even on a quiet day. This strange shape is the result of the seedlings surviving and thriving in the wind environment.

Document 07 : Impact of strong winds on the growth of cypress trees

The result : Air affects living organisms. It is the source of oxygen necessary for the process of breathing and the coal gas necessary for green plants to make organic compounds out of it. The movement of air (wind) is also an enabler for the distribution of plants that grow sheltered from the wind in the opposite sides or tend to grow in the direction of the wind.

How do these abiotic factors affect the distribution and growth of organisms when they become inappropriate ?

Some creatures resist unfavorable conditions such as extreme cold in winter with several solutions.

Activity 06 : Evolution of flora and fauna activity across seasons

The Document (08) represents the life cycle of the bean plant, where it witnesses periods of growth and recovery in the event of appropriate conditions such as water and heat in the spring, and latency periods inside the seed in the event of inappropriate conditions such as winter. If we plant the seed in

the soil where water, salts and warmth are, it grows quickly and turns into a whole plant that blooms and produces seeds again.
The life and activity of annual plants change through the seasons as they grow rapidly at appropriate periods and enter a slow life inside the seed in the event of unsuitable conditions.
Suleiman's ring plant is a perennial herbaceous plant that is widespread in the forests during the spring in its aerial section in the winter, and its earthy stem with its buds and transverse roots remains in the warm soil to restore its activity in the spring.

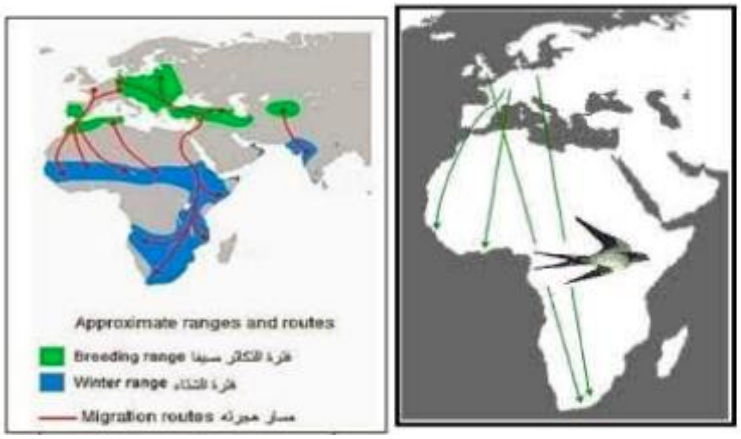
Document (08) : Solomon's Ring Plant on the (right) Beans Life Cycle on the (left)

- When winter comes and the temperature drops, some animals, such as the hedgehog (Figure 1) and the badger (Figure 2) of Document (09), shelter in their dwellings, where they are cut off from food and limit their activity so as not to consume energy, and then enter into hibernation for up to six months, after taking all precautions to protect themselves. This phenomenon is called Hybernation.
- The brown bear disappears into a compartment and enters a state of deep sleep, slowly consuming the grease that was saved in its body during the summer.

Document 09 : Hibernation

Activity 07 : Migration

When winter arrives, swallows migrate from Europe to Africa, cutting thousands of kilometers in search of warmth and food.
Document (10) shows the paths taken by the swallow in its migration from Europe to Africa, where it can reach South Africa
As well as the migration of white storks, the distance travelled by white storks from Morocco to Tanzania is d :
d = 8.5 cm x 150000000 = 1275000000 cm = 12750 Km



Document (10) : Migration of both white storks (right) and swallows (left)

- These data show that storks travel a long distance during the migration phenomenon, in search of suitable climatic conditions. So climatic factors changethe activity of white storks.
- Themigration of these birds is repeated during the same period of the year, to places with moderate temperature, which shows that the factor affecting the migration of white storks and swallows is the heat factor.

Migration is not only about birds and the search for food, but there are other animals that migrate for the purpose of reproduction such as salmon

Conclusion

Organisms resist inappropriate conditions such as extreme heat, cold, lack of water and food in several ways

- Slow life : Such as winter hibernation in some animals.
- Migration : leaving the place of origin to distant places in search of food, warmth and reproduction.

A Summary

Knowledge of the relationships between living organisms and the surrounding environment requires two conditions, the first is the study of the characteristics of the geographical environment in which living organisms live, and the second is the study of the actions and reactions of living organisms in this environment. It is the natural conditions, energy, chemical and biological conditions that make up the environment or environment in which an organism lives.

1. Temperature :

Air temperature as well as soil temperature is one of the most important factors that must be available to the organism. This factor plays a crucial role in the biological developments of living organisms as well as their geographical distribution.

1.1 The effect of heat on plants :

The effect of heat is clear in the exchange of elements between the plant and the medium in which it lives, as well as in the transformation of materials and their movement in the plant body, where temperature affects the process of chlorophyll representation and geographical distribution and the process of transpiration in addition to the effect of temperature on the opening of flowers and on the development and size of plants. We can also observe the effect of temperature on the morphology of the plant (that is, the change in the shape of the plant). Heat can accelerate or slow down the chemical analysis in living bodies, and in general plants can live at temperatures between 0° C and 50-45° C.

1.2Classification of plants according to their need for temperature :

According to the need of plants for temperature, they are divided into four sections :

1-Plants that adapt to a high temperature rate of more than 20°C. These plants are called hot plants Megatherm
2-Plants that have adapted to a temperature range of 20-15° C. They are called Mezotherm-
3- Plants that have adapted to an average temperature between zero and 15°C are called Microtherm plants.
4-Plants that have adapted to a low temperature rate are called cold zone plants.Hekistothherm

1.3Effect of temperature on the animal :

There is a clear and significant effect of temperature on the animal, although some animals can live in areas where temperature changes or fluctuates. Animals have reactions to temperature change. It was divided into two groups :
The first is Hemeotherm with a constant temperature. The second group is cold-blooded animals and the effect of temperature on the animal
can be limited to the following :

- Temperature is also shown to have an effect on the size of the animal's body.
- The temperature also affects the thickness of the animal's skin.
- Temperature also affects the color of the animal
- Temperature also affects the development period of the animal and the activity of the animal

Animals, depending on the effect of temperature on them, can be placed in two groups :

1. Animals that tolerate a large fluctuation in temperature are called. Euritherm

Examples : Hydrobia lives in a spring in Italy with a water temperature of 46°C and can still withstand a temperature close to zero degrees Celsius.
Bufo bufo spreads in many areas up to North Africa and also lives in the Alps at an altitude of 2200m.

2. Animals that tolerate little fluctuation in temperature are called Stenotherm and these are divided into two parts :

a- Heat-loving animals. Thermophyle
b- Psichrophyle

Examples: Coral animal that builds coral pavements and lives only in warm seas whose temperature exceeds 21° C. Thermosbaena, which lives in hot water up to 48 °C, dies if the temperature drops to 30 °C. This group is followed by many large-sized marine wanderer species such as tubulars and meadows that live only in Mediterranean or even tropical waters.
Animals can be divided into two main groups according to their relationships to temperatures :

a.Poikilothermic Animals(Ectotherms) :

They are also called exotherms whose body temperature approaches the temperature of its environment directly. This degree may be very close. For **example**, when the earthworm *Lumbricus agricola is submerged in* water, it adapts within two minutes to the temperature of the water.

b.Homeothermic Animals :

They are also called endotherms because they have the ability to regulate their internal body temperatures independently of the temperature of the environment within wide limits.

2. Soil and Air Moisture

2.1 Effect of Soil Moisture on Plant :

Soil moisture Water is a carrier of salts and minerals necessary for plant life. The elements taken from the soil by the roots and transported until the leaves carry out a natural food supply if the amount of water absorbed from the soil is an uncontrollable amount. In order to reduce water loss, plants have formed special organs to cope with this natural condition, where they have well-absorbed roots and at the same time their upper organs have adapted to very small or spiny leaves to reduce the process of significant water loss.As for aquatic plants, which are surrounded by water on all sides, they do not need to have special organs to absorb water, as these plants absorb water by all organs of their body and their roots are very few or no. As for terrestrial plants, they absorb water from the soil by the roots when the groundwater level is close to the surface, and here we find that the roots develop near the

surface of the soil. However, if the groundwater is deep as in dry areas as well as in permeable rock areas, the roots become longer until they reach the moisture layer.

2.2 Types of plants according to their need for soil moisture :

Hydrophytes Plants with high moisture
Hydrophytes Plants that need moderate moisture Mezophytes Dry plants Xerophytes

2.3 Air humidity (Water vapor in the air)

is very important in plant life as much as water vapor in the soil plays in an atmosphere saturated with water vapor, the transpiration process is very weak, on the contrary, in dry areas where water vapor quantities are low and transpiration is strong. Some desert plants have a salt layer on their surface where, in summer, salt absorbs a bit of water vapor or air moisture.

Plants are divided according to their need and adaptation to soil moisture

1- Halophytes These plants live in soil with sufficient moisture, but they are saline.
2-Plants that live in Oxiphytes
3- sour moisture Plants adapted to low-temperature moist soil Psichrophytes

The organisms in the world are divided into Stenohydriques, organisms that do not tolerate large differences in the quantities of water available to them. Euryhydriques are organisms that adapt in waterless or water-intensive environments. For plants there are biological patterns determined by the proportion of water available.

3. Wind :

Through the speed and direction of the wind, organisms show different reactions, and as we know, wind was one of the main reasons for the spread and expansion of the areas of living organisms. The wind directly or indirectly affects the morphology of the plant or its propagation areas, as well as the transpiration process of plants, in addition to increasing the amount of evaporation from the soil surface and leaves, which affects the plant and its flowers.

4. Snow

Snow is a climatic factor of particular importance in mountainous and polar regions. By accumulating it on branche, snow always shortens the length of the bushes by breaking their branches. Another factor of snow demolition on plants is avalanches, which occur on the rugged sloping slopes, which often leads to the determination of the upper boundaries of the forest in mountainous areas.

5. Light

5.1The effect of light on the plant :

-1Except for bacteria and mushrooms, as well as plants that do not contain chlorophyll, all green plants need light for photosynthesis.
2- Light affects the process of evaporation/ transpiration also for green plants, the process of transpiration increases with the increase of light and becomes weak when the sunlight is tilted, that is, when the light is weak.
3- Light affects the growth, development and shape of plants, especially green plants. As for plants that live in darkness, their stems are long and thin, their leaves are underdeveloped, and their color tends to be between white and yellow due to the absence of chlorophyll.
As a result of all of the above, plants can be divided into several sections :

A- Plants that live in dense light and are called photophyle
B-Plants that live inthe shade (shadow-loving) Umbrophyle

The length of light affects the weight of the plant. Plants that are exposed to light 14hours a day are four times less weight than plants that are exposed to light 7hours a day.Plants can adapt to light as follows :

- Polar plants that live in a long period of light for 6months are somewhat similar in shape to desert plants for the long duration of solar radiation.
- Many plants in the high alpine areas that are exposed to strong solar radiation and strong winds turn to protect themselves like a black grass plant. Calluna, where we find that it is covered with a waxy layer that reflects light, and some of it has a thick leg bark so as to reduce the leakage of light inside, such as blueberries .Vaccinium
- Some plants turn their fruits towards solar radiation. In the morning, the fruit is oriented in a vertical direction with the surface of the earth and faces the sun's rays. At noon, we find that the fruit has moved to parallel the surface of the earth towards the sun as well, like the lettuce plant Lactuca sativa
- Plants begin to grow in the slopes facing solar radiation earlier than the opposite slopes of solar radiation.

5.2 Effect of Light on Animal

Light **affects** animals through their growth, development and distribution as follows :

- With the help of light, animals are directed in their places of spread against the changes taking place in their midst.
- The long duration of light is one of the main reasons for the migration of some small birds, as some of them migrate in the autumn to the south not because of the cold or lack of lunch, but because of the short daylight in the day that gives them enough room to search for lunch.
- Light affects the color of the animal.

5.3Types of animals according to their need for light Animals

Can be divided according to their need for light into photophiles and shadow-loving animals Umbrophyle.As for the diversity of animals by day and night, there are animals that are more active in daylight hours and are called animals that are active in light and heat. There are animals that have adapted to little light and little heat and they are called Durrne .Nocturne

6. Adaptation of organisms to climatic factors

Organisms are exposed to negative changes in the environment such as temperature changes, food shortages and other determinants. Organisms can control these changes in several ways, including :

A.Immigration :

Animals can leave and migrate from the place where they live to another place when emergency negative changes occur, and migration occurs in order to break free from emergency negative conditions or to seek food or reproduction, often instinctively or instinctively.

B.Dormancy :

Some organisms minimize their biological activity when exposed to negative external conditions, and this period of inactivity is called hibernation, and thus the emergency conditions are overcome until they disappear. When conditions return to normal again, organisms resume their activity.

C. Avoidance and Learning

Some organisms overcome negative emergency changes such as high temperatures, drought and other factors by changing the place of residence or modifying their daily and annual activity by keeping animals during the day in their hideouts and looking for food at night.

D. Acclimatation :

The phenomenon of adaptation is a general characteristic of living organisms, as they modify their functions in order to adapt them to the situation in which they live. This adaptation is characterized in heat-heterogeneous animals where they change their metabolic processes. Tropical mammals :

① : Defending against low temperature and is done by :

* Starts to increase metabolism when the temperature of the medium is close to 25°C.
* Its heat output was doubled to 10°C.

Zero Celsius Degrees

② : Defending against high temperature is done by :

- metabolism processes
- Increase heat loss by dilating peripheral vessels.
- Increased sweating.

E. Stillness :

Most terrestrial animals in most temperate areas are adapted to the cold winter and during this season are inactive and in a slow state of life. This condition is common for insects that make up the majority of terrestrial animals, as they are characterized in winter by being immobile, stopping growth, and being water poor. This phenomenon may enter different stages of insect life such as the egg, larva, nymph, or even adult. Many invertebrates have similar forms of resistance, as some fish and amphibian species can spend the winter motionless and embedded in mud.

F. Aestivation :

This phenomenon is found in animals in tropical hot areas, where these animals spend inappropriate segregation, that is, hot and dry segregation in a slow life. This phenomenon is well known to insects and fish, where some of them find themselves confined by the dryness of their natural environment. Many earthworms spend the dry season in a state of summer inactivity, and soil dryness is a deadly factor for them. When temperatures rise, many terrestrial insect species turn to cracks in the ground or under trees, timber, or fallen leaves.

J.Adaptations of desert animals to moisture

-1depend on plants and animals that store a large amount of water in their tissues.
2- Desert animals produce concentrated urine to provide water in their bodies.
3- Some desert animals have an outer cover in the form of scales that enjoy sailing the water.
4. Some desert animals are characterized by night activity to escape the heat.
5- The speed of metabolism decreases in desert animals.
6. Some priorities are transformed by surrounding themselves with a crop that protects them from drought.

Constructed Concepts

- **Bergmann's rule**: The largest size is encountered in members of a single species or in a taxonomic group of heat congeners in colder regions. This rule is supported by a simple thermodynamic assumption that says that the surface of an animal is proportional to the square of its lead. Since the loss of heat is mainly done through the surface, it is proportional to it. This loss will be large whenever the surface / volume ratio is large, that is, the smaller the animal is, or the larger its shape is, that is, the surface / volume ratio is small and therefore the heat loss is small. **For example** : that penguin that lives in the South Pole is larger than the penguin that lives near the equator.
- **Alan's rule** : The appendages of the body of ears, limbs and tails are shorter the colder the place. **For example**: a desert fox has long limbs and large ears, while a polar fox has short ears and a hose. Here it is worth mentioning the term :
- **The biological** pattern (les types biologique) according to the scientist Raunkiaer is the morphological form as a result of the organism's living under certain conditions of heat.
- The **base** of the **fur** : The fur of mammals in cold areas is thicker than the fur of hot mammals. **For example** : on that Siberian tiger, its fur is your name from the fur of the Indian tiger. As

for plants, we notice morphological adaptations caused by physiological adaptations where plants can protect themselves from high temperatures by reversing thermal energy and changing the position of the leaves in relation to sunlight, transpiration and others.... Etc).

- **Impact of Water on Biological Patterns :**

individual organism.	**Humidity of the medium**
Xérophiles	Dry medium
Mésophiles	Wet period and dry period
Hygrophiles	Very Humid medium.
Amphibies	Aqueous medium at intervals
Hydrophiles	Aquatic medium

- The scientist Raunkiaer has divided plants according to the solutions they take to protect their shoots in the cold season

Biological pattern	Description
Epiphytes	Plants that are based on other plants and do not have roots in the ground
Phanérophytes	Most plants of this type have shoots at a distance of 0.25m to 2m from the surface of the earth (trees – shrubs)
Chaméphytes	Buds at a distance of less than 0.25 m from the surface of the earth are kept at the edge of the ice layer
Hémicryptophytes	Directly above the ground, sprouts are preserved with wilt and snow
Cryptophytes-Géophytes-Hydrophytes	There is no air section and the buds remain on tubers, roots or onions
Thérophyes	Annual plants die in the cold season, only seeds remain

a.Lethal temperature :

It is called the higher and lower temperatures that fall outside the thermal limits of the active or active life of the organism, as it cannot tolerate them and dies by the influence of heat or cold, and life becomes more difficult as the temperature approaches the lethal temperature. It also varies from one species to another depending on the environment in which it lives and depending on the season. It has been found that the high lethal temperature of some fish is 36° in summer, but it has decreased to 28° in winter.

b.Optimum temperature

It is the temperature at which an organism performs vital functions optimally. It is the most appropriate temperature at which the activity of the protoplasm reaches its peak. It varies from one type to another depending on the environment in which it lives.

c.Heat near lethal temperature (Coma) :

In which vital functions cease without causing death and in which the organism enters a state of slow life.

Calendar

First Activity :

Climatic factors influence animal behavior. Field observations and laboratory studies provide data on animal distribution areas, and their preferences for climatic factors.The following table gives the results of the experimental study of thermal preferences in blond ants.

> 45	44-40.	39-35.	34-30.	29-25.	24-20.	19-15.	14-10	<10	°C
0	4	18	77	159	45	11	1	0	Number of personnel

1)-Achieved thermal preference curve for blond ants.
2)- From this curve, deduce the animal's optimum temperature and tolerance limits.
Some animals live in environments characterized by water scarcity and poor humidity), (Xénophiles such as the kangaroo mouse.The table before him shows the forms of water loss in two types of mice.

Forms of water loss	In the rat, the kangaroo.	At the mouse
Evaporation in mg/cm3of breathable O2	0.54	0.94
Wastewater in %	45	68

3)-Explain how the kangaroo mouse adapts to its living conditions.You can't "overdie," you can't overdry.

Activity 2.The squirrel Spermophilus isa mammal characterized by intense activity during the summer, digging a hole in the soil that prepares it to spend the winter safe from its predator. This burrow is characterized by aspecial micro-climate, where the temperature is constant in the range of 5°C and the lack of wind and light. With the onset of winter, the google squirrel enters its hole and takes a round shape where it enters into a deep sleep and does not feed, it is the phenomenon of winter hibernation. A lthough he wakes up for a few hours every 15 days, he does not return to normal activity until spring.The following table gives some physiological characteristics of the Spermophile squirrel.

Some Physiological Characteristics	Before Winter	After Winter.
Body temperature in °C	37	2 to 3
Heart rhythm in Batt/mn	350	3 to 4
Mass B g	300 to 400	150

- How the physiological characteristics of a Spermophile squirrel change over the winter. What for ?

Solutions

Activity 1

1)- Thermal Preference Curve for Blond Ants : See diagram below.
2)-Depending on the preference curve, we determine :
- The best temperature is 27 °C.
- The maximum degree tolerated by these ants is 44°C.
- The lowest degree of tolerance is 10°C.

3)-In the kangaroo mouse, we notice a decrease in the percentage of water evaporation when breathing, as well as a decrease in the percentage of water excretion with waste, in order to reduce the percentage of water loss in dry conditions. This explains why this mouse is found in dry areas.
4)- Animals are distributed according to their needs for water and moisture, and thus these animals occupy a medium that provides the appropriate conditions for their living.

Activity 2 :

During winter, the physiological properties of the Spermophile squirrel change, as its body temperature decreases, the heart rhythm decreases, and its mass decreases. So it turns out that squirrel activity is related to the seasons of the year. This shows that climate influences the activity of the Spermophile squirrel.

Conclusion : Animals, during their stages of growth and life, know periods of slow life such as the phenomenon of winter hibernation, and changes in their activity and behavior such as the phenomenon of migration, under the influence of internal hormonal factors, and external factors, especially climatic factors.

TD04 : Terrestrial factors and their relationship to the distribution of living organisms

The soil represents the surface part of the earth's crust. It is an environmental medium characterized by chemical and physical properties that control the distribution of living organisms. It is also a major factor for agricultural productivity by providing the nutrients necessary for the production of organic matter for plants. Soils evolve and their components vary depending on the nature of the parent rock, climatic conditions, and the impact of the organisms that live in it.

Activity 01 : Water Characteristics of Soil "Water Retention Capacity"

Among the factors affecting plant life, soil hydrologic properties to determine the nature of the relationship between soil hydrologic properties and granularity, studies were conducted on 5 types of soil and the results were compiled in (Table 1) :

Extract from Table 1 the relationship between soil granules and their ability to retain water ?

	Coarse Sand	Fine Sand	Sandy Silt	Silt	Clay
Granule diameter	2mm-200µm	200µm-50µm	50µm-20µm	20µm-2µm	Less than 2 µm
A high water holding capacity	1.55	5.5	12	18.9	27.4

The wilting point is estimated by the percentage of water present in the soil when the plants begin to wilt, and (Table 2) gives the wilting point of some plants in different types of soil.

Wilt point in % in soil					
Plants	Coarse sand	Fin Sand	Sandy silt	silt	Clay
Wheat	1.07	3.1	6.5	9.9	15.5
Tomatoes	1.11	3.3	6.9	11.7	15.3
Peas	1.02	3.3	6.9	12.7	16.6
Rice	0.96	2.7	5.6	10.5	13

2-How do you explain the withering of plants despite the presence of a certain percentage of water in the soil ?

3-Extract from Table 2 the relationship between the wilting point and soil texture

4- In your answer, determine the percentage of water that can be absorbed by rice in each type of soil.

Solution :

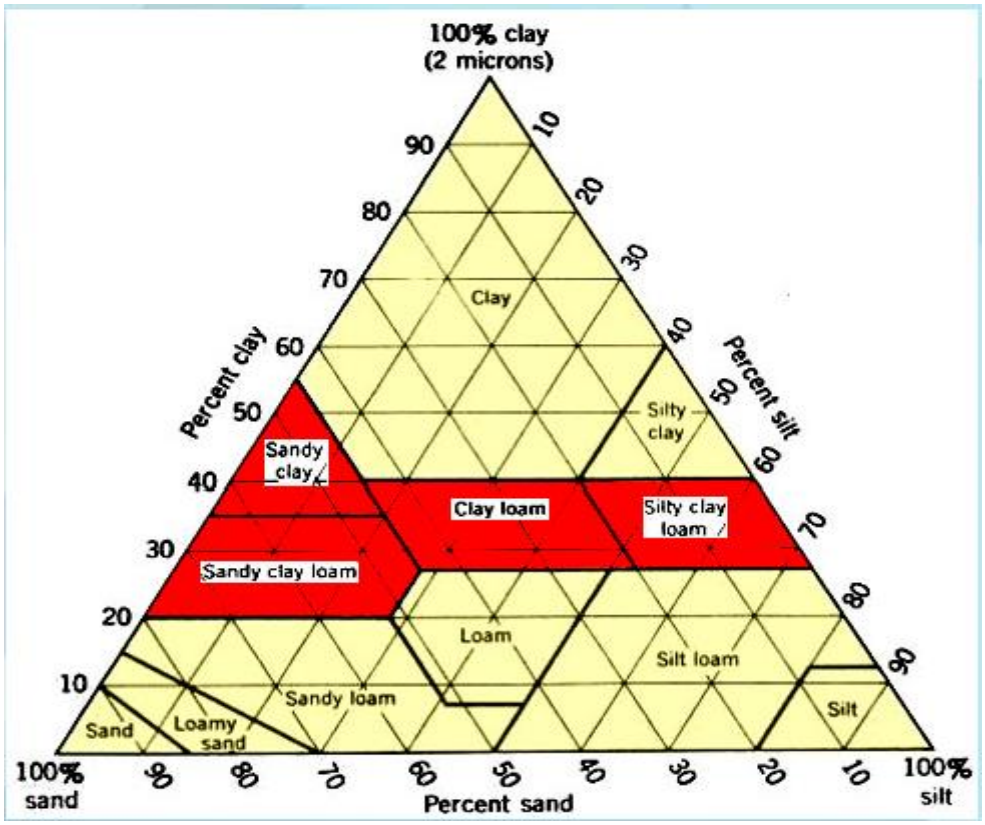
1- From coarse sand to clay, the granules may decrease and the ability to retain water increases, so the smaller the soil granules, the higher their ability to retain water.
2- At the point of withering, the plant begins to wither despite the presence of a percentage of water in the soil because the plant becomes unable to absorb it from the soil (the ability of the micro-pores in the soil to hold water becomes greater than the ability of the plant to absorb).
3- In the various plant species studied, the value of the wilting point increases with a decrease in the soil grain, that is, the lower the soil texture, and therefore the smaller the soil texture, the larger the wilting point.
4- The percentage of water absorbable from the rice tip is the percentage of water saturated to the soil (100%) minus the non-absorbable water, that is, water present in the soil at the point of wilt = the point of wilt – 100%.

	Coarse sand	Fin Sand	Sandy Silt	Silt	Clay
Percentage of water absorbed from the rice tip	99%	97.3 %	94.4%	89.5%	87%

1- Activity 02 : Soil Texture

A soil sample contains 33% silt 33% clay and 33% sand.

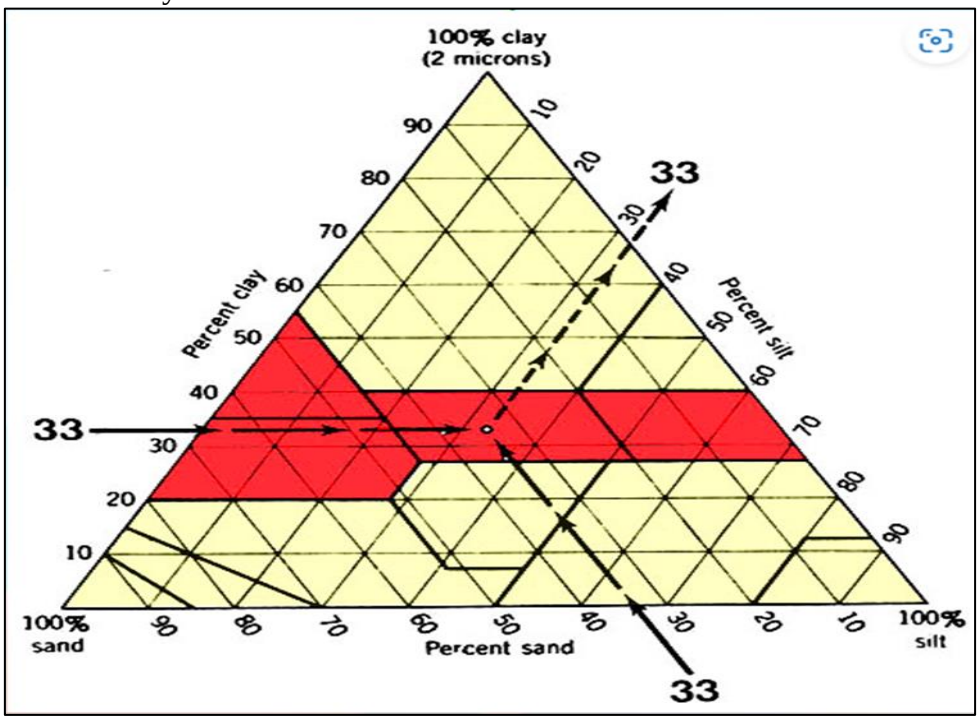
1- **Depending on** the close texture triangle (01), **extract** the texture of this soil.
2- What does granular soil analysis do for you ?
3- Define : soil texture – soil porosity – soil permeability



Document (01) : Soil texture triangle

Solution :

1- By projecting these values onto a triangle of soil texture, we extract the texture of this sample from the soil : clay silt

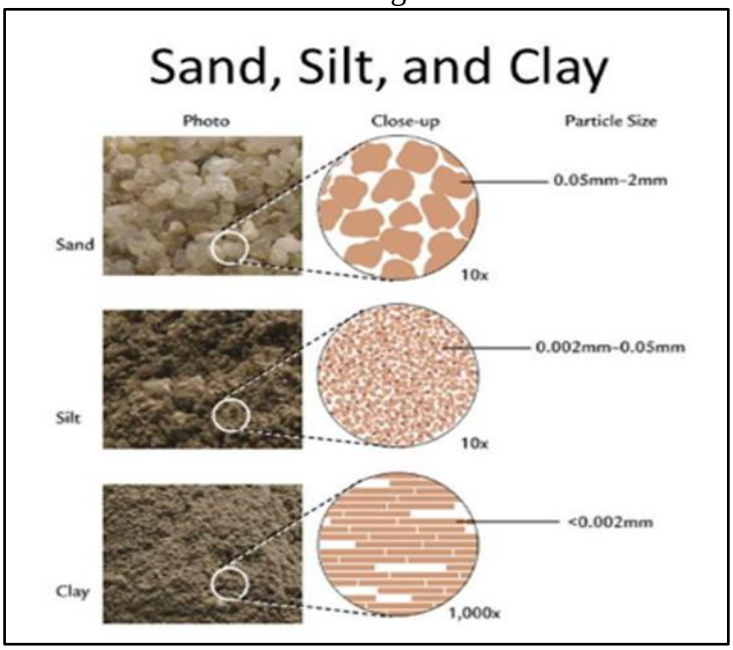


2- The mineral elements that make up the soil vary in nature and size (sand, silt, clay, gravel ....) Thus, granular analysis allows the soil to determine the mineral texture of this soil using a triangle of soil texture determinant.

3- Definition of :

- **Soil texture**

The definition of texture is centered on granularity. A range of texture types can be determined by cod and by the percentages of soil components. By the texture of the soil, we also mean its granular structure, and the granules can be classified according to their diameter as shown in Document (02).



Document (02): Granular Ladder for Physical Components of Soil

- **Soil Porosity :** Porosity is the percentage of spaces between soil grains and has to do with soil texture.
- **Soil Permeability:** Represents the volume of water permeable from the soil during a unit of time, measured after placing it inside a cylinder without a base and pouring a quantity of water to the soil level, after which the amount of water captured is determined within an hour.

Result :

- The process of applying the Soil Texture Triangle is done according to the following steps :

- 1Determining the proportions of soil components of clay, silt and sand through two steps :
  - Using sieves of different sizes to sort the weights of the three soil components.

B.Divide the weight of each of the three components by the total weight of the soil model, and multiply by one hundred (part/ whole x 100).

Percentage of each volumetric category = Category Weight / Total Soil Weight X 100%

2-Pointing the ratio of mud on the mud side of the triangle and the ratio of silt on the silt polygon and so on to the ratio of sand.

3-Three straight lines shall be drawn starting from the indicators specified in paragraph 2 and each of these straight lines shall be parallel to one of the sides of the triangle.

4-The correct direction for drawing a straight line must be parallel to one of the sides of the triangle drawing, and the correct side must be numbered descending The line is a direction with its parallel line. Therefore, the straight line starting from the silt side must be parallel to the mud side, while the straight line starting from the sand side must be parallel to the silt side, and the straight line starting from the mud side must be parallel to the sand side.

5-The point where the three lines meet within a texture triangle represents the type of soil texture.

2-Activity 03 : Impact of Earth Factors on Animal Distribution

The table gives the relationship between the percentage of salinity in the soil, and the number of invertebrate species that exist and are characteristic of this soil.

Low	Medium	High	Salinity ratio — Number of species
295	211	120	Number of species present
16	11	09	Number of characteristic soil types

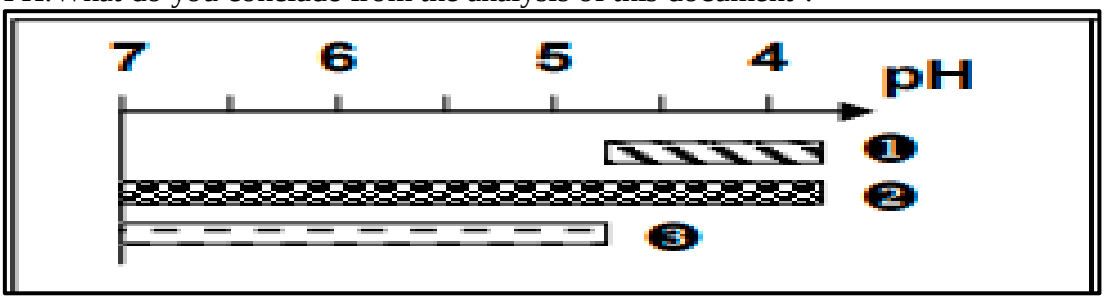
1- Analyze the data of this table
2- What do you conclude form this analysis ?

Solution :

1- The analysis of the table shows that the higher the percentage of salinity in the soil, the lower the number of species present and characteristic of this soil.
2- We conclude from this analysis that soil salinity interferes with the distribution of invertebrate animals.

3- Activity 04 : Impact of soil PH on animal distribution

Document (03) gives in front of him the distribution of three types of earthworms 1, 2, 3 according to the soil PH.What do you conclude from the analysis of this document ?

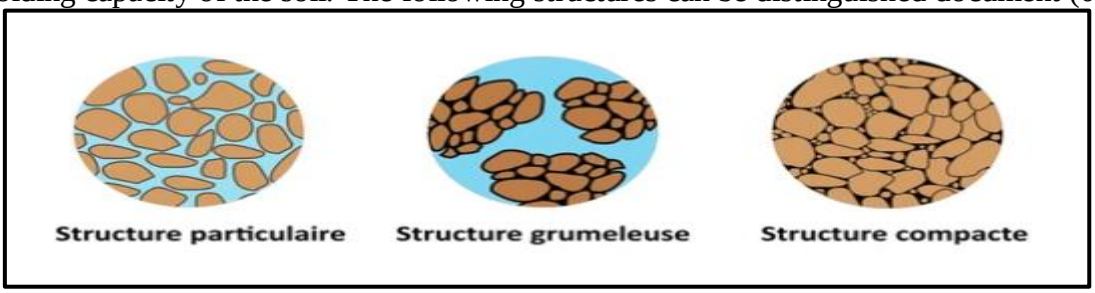


Document 03 : Distribution of three types of earthworms by soil PH

We note that type 1 earthworms are found in soil with low PH. Type 3 is found in soils with relatively high PH and type 2 is distributed in all soils (indifferent type).
We conclude from the observations that soil PH, that is, the acidity of the soil, that is, its chemical composition interferes with the distribution of animals
(Earthworms)

4- Activity 05 : Soil Structure

The structure can be defined by how the soil grains aggregate and is what determines with texture the water-holding capacity of the soil. The following structures can be distinguished document (04) :



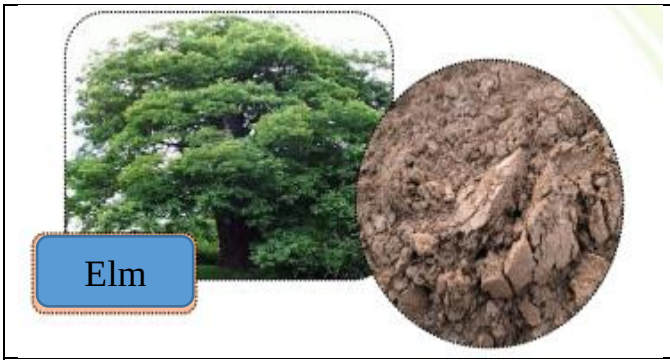
Document (04) : Various Soil Structures

1. **Describe** the three structures.

2- **Extract** the reason for your answer, which of the three constructs is better for agriculture

1- Dismantled molecular structure : sand grains without any link between them
2-Cohesive structure : grains of sand soaked in a diffuse mass of clay
3-Glomerular structure : The grains of sand and silt are collected in bullets by the mud humic compound.
The glomerular structure is the structure that makes the soil good for agriculture, as it allows the passage of excess water and retains a sufficient amount of it. It also allows the roots to be easily penetrated and ventilated well and makes the medium suitable for live aerobic germs. As for the dismantled molecular structure, it does not retain water, while the coherent structure is impermeable to water or air, in which plants choke and resist penetrating the roots.

5. Activity 06 : Impact of soil characteristics on plant distribution :

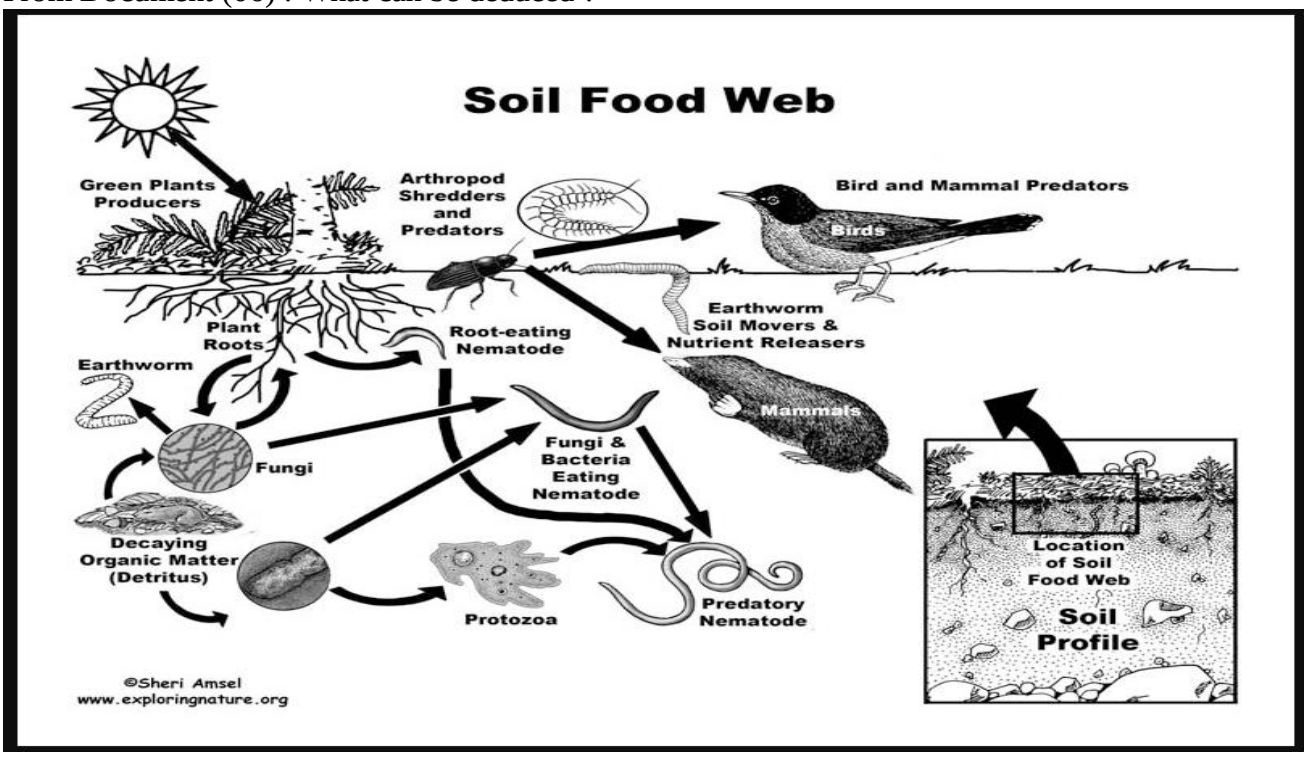
<table>
<tr><td> 
</td><td> 
</td></tr>
<tr><td>Light alluvial soil, fertile, permeable to water and air</td><td>Heavy clay soil, adhesive that isharsh Wet when dry</td></tr>
<tr><td> 
</td><td> 
</td></tr>
<tr><td>Balinese soils rich in mild spongy humus,black limestone Color or dark lush and waterproof</td><td>soils with a light chalky view predominantly permeable to water, dry in summer</td></tr>
<tr><td colspan="2"> 
</td></tr>
<tr><td colspan="2">Textured granular sandy soil, inconsistent with high water and air permeability</td></tr>
</table>

Document (05) : The Effect of Soil Characteristics on the Distribution of Plants

Between the relationship between soil characteristics and the distribution of plants in a specific environment.

6-Activity 07 : Food web in soil

From Document (06) : What can be deduced ?



Document (06) : The food web in the soil

We conclude that the interaction of organisms in the soil with each other and with plants and animals in the ecosystem forms a complex network of ecological activity known as the soil nutrient network. The resilience of this nutrient network is inextricably linked to the biodiversity within the soil.

7-The most important functions (roles) that soil plays in the ecosystem

1. A medium for the growth and development of plants where they provide them with water and nutrients.
2. A supporting bond for the roots of plants.
3. Food production
4. An environment for the growth and development of organisms of all sizes.
5. Soil is the medium for the cycle of elements in nature (nitrogen cycle, carbon cycle, sulfur cycle).
6. A medium for retaining, storing, filtrating, and transporting water.
7. Soil microorganisms are key factors that benefit from good aeration. These organisms play a vital role in the decomposition of organic matter and the release of nutrients in a form that plants can absorb. Good ventilation contributes to providing the necessary oxygen to these organisms, which enhances their activity and increases the efficiency of decomposition processes. This in turn increases the availability of nutrients to plants, contributing to increased biomass production.
8. Soil particle size traits are ecologically important for animals that live in or spend a period of their lives in them. The size of sandy soil particles plays an important role in the distribution of excavating animals in sandy beaches in the tidal area, as these animals differ in their preference for the quality of sand, some of them prefer coarse sand as types of shellfish or others prefer soft sand or tamma, such as the sand worm **Arenicola**.

9. Soil slope is a noteworthy trait because some neighborhoods prefer flat soil and some prefer sloping soil. The depth of the soil is of great importance, and we find many earthworms that can spend the dry summer in the depths of the soil. If the soil is thin, they cannot do so. Only animals that are able to enter the summer lethargy stage remain in the thin soil. There is an important characteristic that distinguishes soil, which is the sizes of molecules of its components, and this characteristic is important for digging animals as well as plants.
10. The darkness in the depths of the soil makes it a natural habitat or refuge for the animal species that fear the light.
11. Lime-rich soil has a dense presence of abdominal snails because these animals need lime to build their shells, especially calcium carbonate $CaCO_3$.
12. Moisture or water content of the soil is one of the important determinants that affect the presence and distribution of animal populations in it. For example, the earthworm is the one that does not tolerate severe drought in the soil and needs soil with a high level of moisture, while high humidity is fatal or harmful to many insect larvae.
13. The deeper we go in the soil, the less oxygen and the more carbon dioxide. Therefore, the conditions of the depths are close to anaerobic conditions, which are preferred by anaerobic bacteria, as well as earthworms prefer a higher percentage of carbon dioxide than is found in the air.

Calendar

Application 01 :

The following table represents the most important stations where the green oak is located in Morocco.

Phases	**The nature of the parent rock on which the green oak grows**
Chefchaouen	Calc and Dolomite
Azrou	Calc and Dolomite
Zarhoun	Calc and Dolomite
Olmas	Chest, quartz or cranite
Za 'ir	Chest, quartz or cranite
impermeability	Lime and sandstone
Beni Yezhnassen Plateau	Lime and Granite

1. What do you conclude from your analysis of this table ?

Answers

Note that green oak grows above acidic soils (schist, quartz and cranite) and basement soils (lime and dolomite). We conclude that green oak is an indifferent species (espèce indifférente) by the nature of the soil.

TD05 : Vital Factors (Nutritional Relationships)

Organisms of all kinds exist in nature with each other and within a certain area, and therefore they exist within a network of interactions in the form of relationships within the same environment. These interactions between species may be positive interactions, negative interactions, or neutral interactions.

Activity 01 Organisms living in the same neighborhood

are associated with various relationships : social – reproduction – neighborhood relations - food relations.

(1- Define each type of relationship mentioned in the exercise, giving an example of each relationship.

(2-What are the most important types of relationships that exist between organisms of the same nature? Your answer

(3- Identify the relationships between the organisms mentioned in the following examples :

- **Example 1** : Fungi grow on top of a layer of animal manure in moist places and feed on organic materials that are found in animal manure or any other dead plant organism.
- **Example 2** : Foxes in some fields are among the factors that limit the losses caused by rodents in crops, as it is estimated that each fox feeds annually on about 6,000mice.
- **The third example** : Mold (non-green plants) grows on fruit, bread and some vegetables such as tomatoes if they are placed in moist places and feed on organic materials that are found in these bodies
  4- What is the difference between the relationship between the first and third example objects on the one hand and the second example objects on the other hand ?
  5- Name these two types of relationships.
  6-Define each of the two types.

Activity 2

To understand some of the complex nutritional relationships that organisms have among themselves, we suggest the following examples :

↔Example 1 : Rhizobium bacteria live on cottonseed roots, Légumineuses. In each hectare of alfalfa, these organisms convert 300Kg of air nitrogen into nitratent used by cottonseed. In turn, bacteria absorb from the plant some of the water that is found in the roots, which they cannot absorb directly from the soil.The second

↔example 2: In the digestive tube of some ruminants, there are primary animals and Escherichia coli bacteria in huge numbers that contribute to the digestion process. Cellulose converts plant foods into simpler chemicals that these animals can digest. On the other hand, they use part of the food eaten by ruminants.

(1) What distinguishes the nutritional relationships between the organisms mentioned in the previous two examples ?

(2) What is the name of this type of food relationship ?

(3) Define this type of food relationship.

Example 3: The following table shows the development of the soft mass of one of the plant types according to the intensity of its cultivation in the field:

	Fields			
	D	C	B	A
Separation distance between seedlings in md	0.6	0.4	0.2	0.1
Area allocated to each sapling in dm2	0.36	0.16	0.4	0.1
Seedling density in m2	2.77	6.25	25	100
Soft mass rate in gm	46	44	29	17

(4) Analyze the table.
(5)What do you conclude ?
(6) This type of nutritional relationship defines the

Solution of activity 1

↔ (1) Social relations are the relationships between living organisms belonging to the same species that live in groups with a type of hierarchy, that is, the individuals who live in the group do not have the same role or importance: beehives – ant hives – herds of wolves and lions and some types of monkeys or deer where stratification prevails among the members of the group.Reproductive
↔relationships between two different genders (male – female) of the same sex. Example breeding relationships between a lion and a lioness.Neighborhood
↔relations : combining creatures of the same species or different species living next to each other, such as herds of elephants living in
the same living places as giraffes, deer and zebras.
↔Relations : It is a relationship between two organisms of two different species, one of which provides food for the other (grasses and cows).
(2) The most important types of relations that exist between organisms of the same nature are food relations because they determine the type of organisms that exist in each medium. There are no living organisms in a medium unless their strength is available in it.
(3) The relationship that brings together the organisms mentioned in the previous examples is nutritional.
(4) In the first and third examples, there is a living organism that feeds on the remains of dead organisms. In the second example, there is a living organism that feeds on another living organism.
(5) The first type is known as : Saprophytisme
- The second type is known as : Prédation
↔ (6) Saprophytisme : A food relationship where the organism feeds on cadavers and the remains of other organisms (roots – fruits – dung - cadavers – leaves ...)
↔Predation: A food relationship that combines an animal (predator) that feeds on an animal (prey). Predators are characterized by the development and growth of organs associated with hunting and predation behavior (sense organs to locate prey – movement organs to move and catch prey – oral apparatus or claws to catch, tear, and devour prey).

The solution of Activity 2

(1) that characterizes the nutritional relationships between the organisms mentioned in the previous two examples is that both organisms benefit from
each other and for them the relationship is not optional, that is, necessary.
(2)The name of this type of food relationship: Symbiose
(3)Coexistence is a type of food relationship that combines two participants of two different types who benefit from each other and
cannot live without the relationship that they have, that is, it is necessary for them together.
(4)The lower the number of seedlings in the field, the higher the soft mass of the plant.
(5) There is compétition between seedlings for field resources.

(6)Competition : is a relationship between individuals belonging to the same species (competition of the same species) or individuals belonging to different species (competition between two species) living in the same medium and competing between them for housing, food, living resources, water, light and mating. The greater the demand for these things than the medium provides, the stronger the competition will be and may lead to the exclusion of one or several species of organisms.

Competition is a determinant of the intensity of the spread of many organisms.

Because the competition takes place on the natural sources of organisms from food and place and varies according to the physiological aspect between similar and dissimilar individuals, and according to existing organisms, competition occurs and the increase of one species reduces other species.

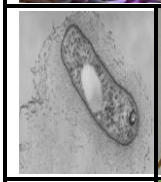
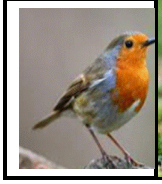
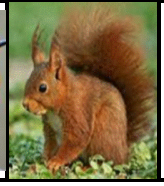
Activity 3

Read the paragraph and answer :

There is a type of crocodile that attacks humans and this type cooperates with birds to brush their teeth and eat waste these birds, with their feathers, transport the seeds from one place to another, making them germinate, especially the bean plant, which cooperates with bacteria to build nitrogen for the beans.

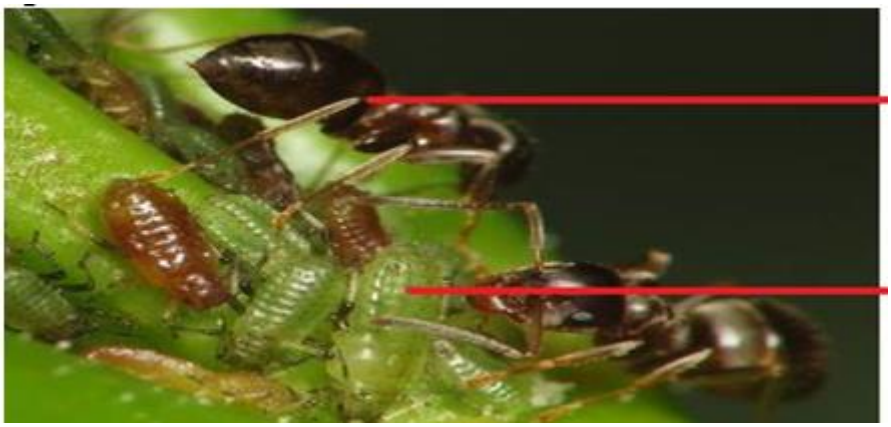
1-The relationship between the crocodile and people [predation].
2-The relationship between the crocodile and the birds [barter].
3-The relationship between birds and beans [spread].
4-The relationship between bacteria and beans [barter].
5-The absence of bacteria makes the beans [die and end]

Examples of food relationships :

	Mosquitoes feed on human blood. The mosquito is the human parasite that represents the host.The nutritional relationship between humans and mosquitoes is parasitism.
	Livestock egrets feed on parasite that live on the skin of cows. The two species can live separately, so this is an example of a cooperative relationship.
	The lion hunts zebras for lunch. The lion is the predator and the zebra is the prey. It's a predatory relationship.
	Hyenas and lions hunt the same prey, so there is a competitive relationship between these two species.
	Coexistence is a relationship that is beneficial to one type and neutral (neither beneficial nor harmful) to another. For example, a clownfish hides in coral reefs made up of sea anemones.
 	Rhizobium bacteria live in soil. These bacteria have a symbiotic relationship with leguminous plants (such as beans, beans...) where they are nodules. In these nodules, Rhizobium bacteria convert aerobic nitrogen molecules (N_2) into ammonium (NH_4^+) necessary for plant growth.
 	There is no direct nutritional relationship between the squirrel and the robin, it is an example of a neutral relationship.

Activity 04

In nature, the following scene can be observed : the pucerons absorb the sap of the bean stems, while the ants rush behind them and absorb their feces (rich in sugars) and guard against cleaning and protecting them.



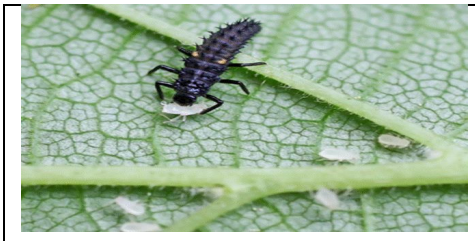
1. What kind of relationship exists between bean stalks and insomnia ?

We conduct the following experiment on two sets of bean stalks. The table below summarizes the circumstances and results of this trial.

	Experimental conditions	**Findings**
1 group	A medium containing bean stalks with insomnia.	- Slow growth of insomnia. - A few for insomnia. - Good product of beans.
Group 2	A medium containing bean stalks with larvae and ants.	- Rapid growth of insomnia. - Strong reproduction of insomnia. - A weak product of beans.

2. Determine the type of relationship that exists between ants and insomnia on the one hand, and between beans and ants on the other.

Coccinelle larvae consume 20 to 40 larvae a day, while adult larvae kill more than 200 larvae a day.



Picture of a ladybug caterpillar feeding on larvae

Picture of an adult ladybird feeding on insomniacs

2. What kind of relationship exists between insomnia and ladybirds ?

The following table summarizes the various interactions that can take place between organisms of a medium.

Relationship	Impact of Type A on Type B	Impact of Type B on Type A
a	nihilistic	nihilistic
b	useful	useful
c	useful	detrimental
d	detrimental	detrimental
e	nihilistic	useful

4. Identify the pattern or patterns of relationships related to states : a, b, c, d, e.

Answers :

1-The type of relationship that exists between bean stalks and insomnia is that of parasitism.

2-Thetype of relationship that exists between ants and insomnia is cooperation. The type of relationship between beans and ants is that of neutrality.

3-Thetype of relationship that exists between insomnia and ladybirds is predation.

Relationship	Impact of Type A on Type B	Impact of Type B on Type A	Type of Relationship
a	nihilistic	nihilistic	Neutrality
b	useful	useful	solidarity
c	useful	detrimental	Predation or parasitism
d	detrimental	detrimental	competing
e	nihilistic	useful	coexistence

Summa

1. Living agents in the same species (Homotypiques)

These relationships are multiple and varied, the most important of which are :

1-1 The effect of the group : It is the effect by which individuals of the same species affect each other. It is a positive effect that benefits all members of the group. This effect occurs between two to thousands of individuals. It results in the rapid growth of the clan, that is, the increase in the number of individuals by increasing the percentage of births, the collective search for food, self-defense and the young, so we reach the concept of the minimum number of individuals (la population minimale), for example: a herd of elephants in Africa becomes extinct if the number of its members does not exceed twenty-five (25). Each animal species has its own number.

Example: It has been observed that the only larvae of the migratory locust are little active, but if we collect them, they become very active, as the appetite, growth speed, fertility, and reaction to environmental factors change, and we call this phenomenon the addition effect.

1-2 Mass Effect : When the group's effect is prolonged and the number of individuals increases until it reaches the overcrowding of the middle. The results of this effect are severe on the species and show us the concept of intra-specifique competition (la compétition intra-spécifique).

Intra-species competition : This appears when the number of individuals increases until the medium is not enough to accommodate it, so competition appears for food and for the sovereignty of animals. In plants, competition occurs for light and water.

Example : In some colonies of silver gulls (seabirds) with a high density of individuals (as in the Netherlands), adult gulls are observed to feed on their young.

2-Living factors between species (Heterotypiques)

When two species live in the same space, each is affected by the other. This effect takes the following forms : non-existent, positive, and negative.

First : Negative Relationships :

1-Competition :

Competition is defined as the reciprocal use of limited resources and competition occurs either for food, space, light, wastes, and other requirements necessary for the survival of living organisms. Competition may occur between different species of two or more species (Interspecific competition) or may occur between members of the same species (Intraspecific competition). Competition usually leads to a decrease in the growth of animal groups.

2-Predation :

Predation is defined as the negative relationship between two species, one of which is the beneficiary, which is the predator that kills and feeds on the other affected species, which is the prey. The predatory species may be polyphage, that is, it feeds on several species, or it feeds on a small number of oligophage species that feed on one monophage species. Predation has environmental importance through three points of view :

a. Some predation contributes to regulating the distribution of animal communities.
b. Predation is a major force in natural selection as many adaptations observed as warnings and colorations all illustrate the contribution of the prey-predator relationship to evolution.
c. Predation influences its determination of the distribution and abundance of the population. In the case of its impact on pests, it is useful, while in its impact on prey that is important to humans, it is harmful.

3- Parasitism

It is the living of a small organism on a large organism, resulting in damage that may reach the state of death. Thus, the concept of parasitism is similar to the concept of predation, so what was previously said about predation can be applied to the case of parasitism. The population of the parasite, whether it is bacteria, protozoa, fungi, helminths, or fleas, can strongly limit or regulate the host population in the same way that a predator limits or regulates the prey population.

4- Ammansalisme :

A species that is not negatively affected but stops the growth and reproduction of the other species. This relationship is especially present in plants such as walnut tree, calitos.

Second : Positive Relationships :

1- Mutualisme (symbiose)

Each species cannot do without the other in its life, its growth and reproduction, for example : plants and nitrogen-fixing bacteria. An example of this is the relationship between algae and fungi where fungi provide the structure, moisture, and attachment sites where algae cells grow and algae produce food for themselves and for the fungi.

2-Coopération

The two species form an unnecessary partnership so that both species can live alone, but the relationship, if any, benefits both.

3- Commensalismes

The grouping has a species that benefits and the other does not, such as the collective nesting to protect the eggs, the transfer of a small organism to a large one (phorésie) based on a plant on the last épiphytes)). An example of this is the remora and the shark, where the remora sticks by a sized in its head on the shark for the purpose of easy navigation and also takes advantage of the remnants of food eaten by the shark.

4- (Neutralisme) or neutrality The two types are separate and do not affect each other.

Live Relationships Summary Table

Relation	Both types		Separate species	
		Type B		Type B
Neutrality	0	0	0	0
Competition	-	-	0	0
Coexistence	+	+	-	-
Cooperation	+	+	0	0
Solidarity.	+	0	-	0
parasitism	+	-	-	0
Predation	+	-	-	0

0 : The two types are not affected by the relationship + : Growth is possible or improved - : Growth is low or non-existent

Calendar

Application

- **Compare Coexistence and Mutalism**

Coexistence	**Mutalism**
Not a coercive relationship	Compulsory relationship
Beneficial to one party and does not harm or benefit the other party	Mutual benefit
Like a turtle with a green algae peel on it.	Crocodile and Birds Brushing Their Teeth

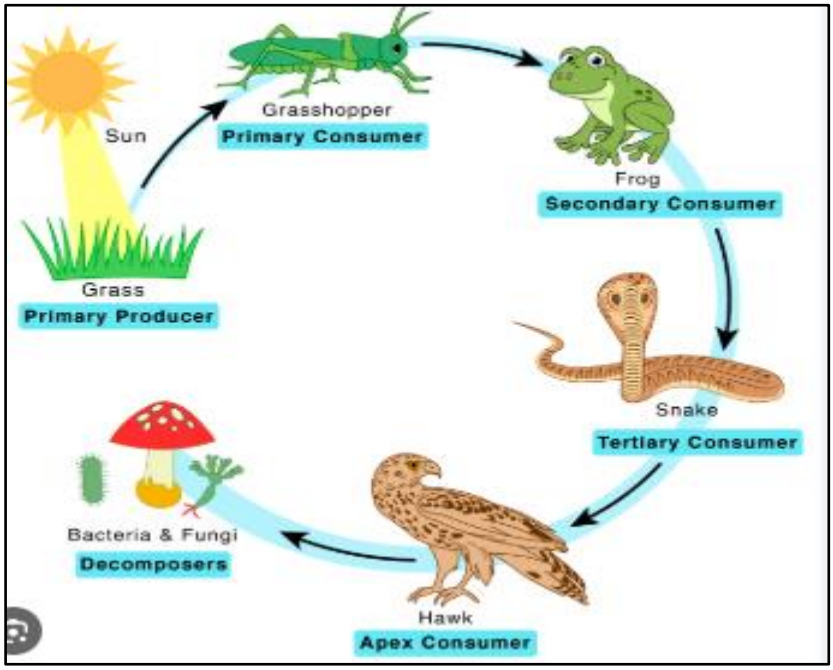
- **There is an overlap between the concept of Parasitism and Predation. How do you distinguish between them ?**

The face of Comparison	**Parasitism**	**Predation**
The similarity.	Relationship between two objects, one of which benefits and the other is damaged	Relationship between two objects, one of which benefits and the other is damaged
The Difference	* The relationship may last throughout the life of the victim. * Thebeneficiary is a parasite and the affected person is a host such as a human and tapeworms.	* The relationship inevitably ends with the death of the victim * Thebeneficiary is a predator and the victim is prey like a lion and a deer.

TD 06 : Flow of matter and energy within the ecosystem

Activity 01 :

Locusts feed on green plants, but they are eaten by birds, and these in turn may be eaten by snakes, and snakes may be hunted by some quasi-secret.



(1) What do these animals form among themselves ?

(2) Summarize this relationship in the form of a chart using the symbol (⇐eaten by).

(3)Give a definition of this relationship.

Solution :

1) These organisms feed sequentially among themselves, so these organisms form a food chain.
2) Green Plants⇐ Locusts ⇐ Frogs ⇐ Snakes ⇐ Crackers Consumer
   Product I Consumer II Consumer III Consumer III
3) A food chain is a sequence of food relationships between a group of organisms within a given ecological vector. The food chain consists of rings, where each organism occupies a specific location within the group, and we find : Producing organisms : Les producteurs are chlorophytes, which produce organic matter from mineral matter thanks to the process of photosynthesis.

   • Consumed organisms : Les consommateurs are organisms that use ready-made organic materials and we distinguish within this group :

- ✓ Top-tier consumers : Animals with a herbaceous diet.
- ✓ Second-tier consumers : Carnivores that feed on herbivores.
- ✓ Tertiary consumers : Carnivores that feed on other carnivores.

Remarks :

- ❖ Another class of organisms based on the transformation of organic matter into mineral matter, called the class of analysts (Les décomposeurs) can be distinguished from bacteria, fungi, worms, insects ...)
- ❖ A class of consuming organisms that feed on plants and animals can be distinguished called the category of human omnivores the pig
- ❖ Some organisms change their diet according to the seasons of the year.

Activity 02

In one of the forests of Africa, one of the food chains consisting of a lion, calves and grass was monitored for a year. During the study period, it was found that the weight of the lion increased by

48 kg after eating about the weight of four and a half calves (4.5), which in turn consumed about 4 hectares of grass.
The table shows other data related to the same food chain :

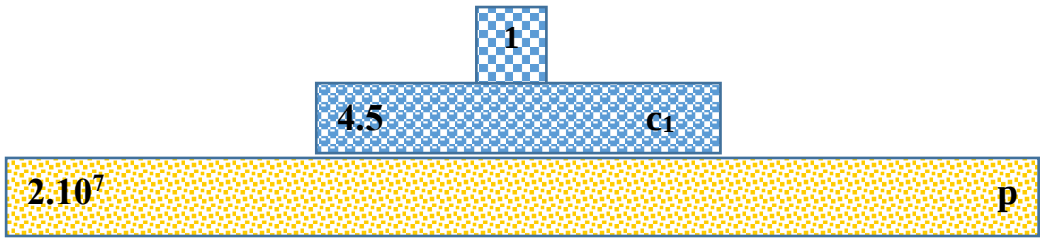
Food chain.			
Grass	**The Calves**	**Lion**	
			Diet
			Nutritional level
8,211	**1035**	48	**(Kg) Living Mass**
27	**4.5**	1	**Number of individuals**
$6.2\ 10^7$	**56**	$3.4\ 10^4$	**Energy**

(1)Knowing that,
- Biomass : Biomasse is an estimate of the total mass of living matter of organisms that are one of the links of the food chain on the unit of area and is expressed in : g/m2 or t/ha or Kg/ha
- Energy : Energie is the energy that represents the various living masses available at each nutritional level and is expressed Kj/m2.an or Kcal/m2.an
A - Fill in the blank in the previous table.
B -Complete the pyramid of numbers for the series mentioned in the exercise, knowing that the pyramid of numbers or the pyramid of individuals Pyramide des nombres is a graph that expresses the change in the number of individuals from one level to another within the food chain with the selection of an appropriate ladder so that all levels of the pyramid are represented (.
(2) Complete the biomass pyramid of the series mentioned in the exercise, knowing that the pyramid of biomass is Pyramide des
Biomasses is a graph that expresses the change in the amount of biomass from one level to another within the food chain.
(3) Complete the energy pyramid of the series mentioned in the exercise, noting that the pyramide des énergies is a graph that expresses the flow of energy within an environmental load of solar energy to the last consumer within the food chain.
Note : Used herbs within the food chain absorbed an energy of .926.3.10 Kj
(4) For living mass : Calculate the production yield or yield between all levels of the food chain using the following formula
Production yield per biomass = Return per biomass = Biomass for level 2x100 / Biomass for level 1
(5) For energy, calculate the production or yield between all levels of the food chain using the following formula :
Energy Production Yield = Energy Yield = Energy Level 2 x 100/ Energy Level 1
(6) What do you conclude ?
(7)How do you account for that ?
(8) What do you know about the energy lost between nutritional levels ?
(9) In the form of a table, calculate the flow of energy between food levels, noting that : Heat flow is that leakage of energy when it moves between the different levels of the food chain and is expressed in the following formula:
A=The total energy reached by the nutritional level in Kj
PN= specific level energy in Kj
R=Energy wasted by breathing in Kj
Solution :

1) A-

	Food Chain.		
	Grass.	The calves.	The lion.
Diet	Autotrophic	Herbivorous	Carnivorous, Sarcophagous
Nutritional level	P	C1	C2

B-Pyramid of numbers :



2) - The pyramid of living mass :

For the ladder we choose every 1cm = 500kg

deduce the length of the rectangles that will form the pyramid (Note : Its normal thickness (1cm)

↔for grass should notexceed

1cm ---------- > 500kg

X = 8211/500 = 16.4 cm

↔For calves :

1cm ---------- > 500 kg

X cm ----------> 1035 kg

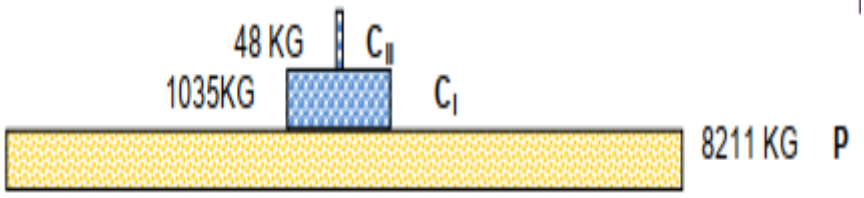
X = 1035/500 = 2 cm

For lion :

1cm ---------- > 500 kg

X cm ----------> 48 kg

X = 48/500 = 0.1 cm



3. Energy pyramid

For the ladder we choose every 1cm = 10^7Kj

deduce the size of the rectangles that will form the pyramid (Note : Its normal thickness (1cm)

↔ for grass : 1cm ---------- > 10^7 kj

X cm----------> $6.21.10^7$ kj X = $6.21.10^7/10^7$ = 6.2 cm

↔For calves : 1cm ---------- > 10^7 Kj

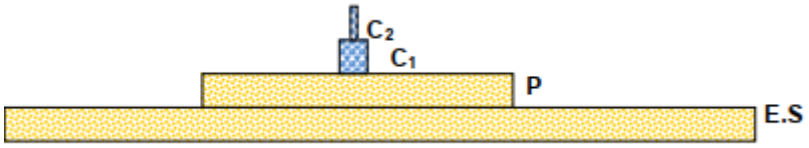
X cm ----------> 5.10^6 kj X = $5.10^6/10^7$ = 0.5 cm

↔For : lion : 1cm ---------- > 10^7 Kj

X cm ----------> $3.4.10^4$ kj X = $3.4.10^4/10^7$ = 0.0035 cm

↔For solar energy : 1cm ---------- > 10^7 Kj

X ----------> cm $26.3.10^9$ kj X = $26.3.10^9/10^7$ = 2630 cm



(4)+(5)

	Live Mass Yield	Energy Efficiency
between the calves and the lion	4.6%	0.7 %
Between grass and calves	12-6%	8%
Between the grass and the sun	0.23%	
Overall payoff	Between Lion /Grass=0.58%	Between Lion /Solar =0.00013%

(6).The more we move in the food chain towards the last consumé, the more :

- The yield of biomass production has decreased.
- The efficiency of energy production has decreased.

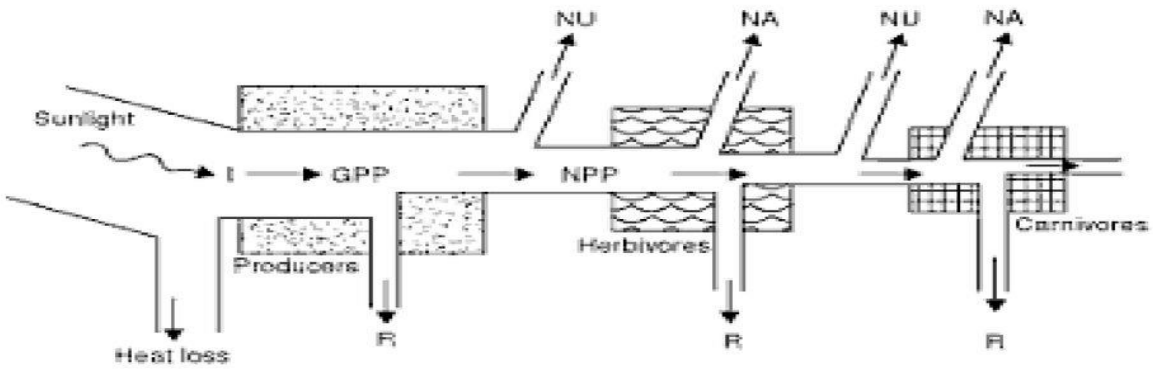
There is a great loss of energy and living mass between the nutritional levels so that the level benefits only a very small part of the energy and mass of the previous level.

(7) The loss of energy and living mass between food levels can be explained by the fact that organisms that eat organic materials from the outside do not use all that mass in building their body, but use the bulk in covering other body needs such as thermal regulation, movement and reproduction... (Lost by breathing (As for the grass, it is exploited in the process of photosynthesis.

(8) The energy lost between levels is known as heat flow.

(9)Energy Flow Between Dietary Levels :

	R	PN	A
The flow of energy between the sun and the grass	$26.2*10^9$	$6.2*10^7$	$26.3*10^9$
Energy flow between grass and calves	$5.7*10^7$	$5*10^6$	$6.2*10^7$
Energy flow between the calves and the lion	$4.96*10^6$	$3.4*10^4$	$5*10^6$



One-way energy flow model showing unidirectional flow through primary producers, herbivores and carnivores. At each successive trophic level there is huge loss of energy (I = Solar energy input ; GPP = Gross primary production ; NPP = Net primary production ; NU = Energy not used ; NA = Energy not assimilated e.g. excretion ; R = Respiratory loss).

Document 01 : Energy flow through the trophic levels

Decrease in energy flow is observed from one level to another due to :
- Loss of energy while breathing organisms : R
- Loss of part of the non-consumable material by animals : NU
- Loss of another part of the material that is not represented to be excreted with waste : NA

In general, productivity can be divided into the following :

1-Primary Productivity (p.p.)
A. Gross Primary Productivity (G.P.P.)
B- Net Primary Productivity (N.P.P.)
2. Secondary Productivity (S.P.)
A. Gross Secondary Productivity (G.S.P.)
B- Secondary Net Productivity (N.S.P.)

Conclusion

1- Food Chain :

It is a consumer sequence of food among living organisms, showing the reasons for the transfer of energy between them, so that it begins with one of the food-producing organisms, and ends with one of the decomposing organisms, or it is the transfer of food energy from one organism to another, and each organism gives the other less energy than it took from its predecessor, and it is worth noting that the disappearance of one or more types of organisms in an environment leads to an imbalance in food chains.

1-1 Food chain in the forest environment : Wheat is →a consumer mouse product that feeds on wheat→Snake Consumer that feeds on mouse→Falcon Consumer that feeds on snake.
Solar energy→ weeds→ rabbit →fox→ Lion → decomposing organisms.
Weeds→Insects→Frogs→Snake→Bacteria.flower → The butterfly → the frog →the snake →the hawk.

1-2 Food chain in a desert environment : Desert Plant→Locust→Chameleon→Falcon→Bacteria.
1-3 Food chain in an aquatic environment : algae→ animal wanderers → small fish→large fish→ bacteria.
From the previous food chains, we conclude that every organism in the previous chains does not depend entirely on one type of food, but can feed on more than one type, for example : a falcon can feed on a rabbit, or on a snake, or small birds, or food rats, and then to an environmental imbalance

Food chain: is a single pathway for the food relationships that exist between organisms in an ecosystem that results in energy transfer.

- The beginning of the food chain is a product (herbs / seeds / algae).

2- Food chains are divided into 3 types

2.1 Predatory food chain

It is the one in which all living organisms depend on predation for food. They feed on animals that eat grasses. These food chains are spread in forests, large pastures, and their most famous species are large cats, which contain: (lions, tigers), hyenas, and wolves. They feed mainly on deer, cows, elephants, and other grassy animals.

2- 2 Parasitic Food Chain

It is the one that depends on intruding on the food of other organisms, so it gets its share without the need to prey, or attack other organisms. Here, on the contrary, the size of consumers decreases as levels increase and their number increases.

2-3 Throw Food Chain

They are prevalent in all **ecosystems**, but they predominate in shallow land or water systems. These chains begin with non-living organic matter and end with decomposing microorganisms. For example : One of the features achieved by throwaway cycles is the reconstitution and recycling of food, which urges that plants, microorganisms and small animals exist together and that food is quickly reabsorbed directly by a particular species after being excreted from another species.

3- Levels of the food chain

The food chain is divided into several different levels, as follows :

3-1 Products

Products are known as autotrophic organisms (Autotrophic) that is, they make their own food, so they are an important part of the food chain and the ecosystem alike. Green plants are the main products on land, while algae are the main products in aquatic systems such as seas and fresh water. This is done through:

- photosynthesis: The process of photosynthesis means the use of some living organisms such as plants, algae, and phytoplankton Sunlight to convert carbon dioxide and water into glucose, as it consumes most of the energy produced by products in the process of photosynthesis for the growth and maintenance of products, and a small part of this energy is transferred to consumers when consumed.Chemical
- construction: Chemical construction is the process of converting carbon compounds into food, and the organisms that produce their food in this way are a type of bacteria that live in volcanoes.

3-2 Consumables

Consumers are defined as living organisms that derive energy and nutritional needs on other living organisms, representing the second nutritional level and including herbivores) ,(Herbivores and carnivores) (Carnivores, examples of which are lions, spiders, and omnivores, i.e. carnivores and plants together) (Omnivores, examples of which are bears and most types of birds and humans, and the consumables are divided into:

- **Primary Consumers**:feed on products, as they include herbivores that eat plants and herbs, and

the main consumables may be algae and bacteriophages) ,(Bacteria Eaters, examples of which are birds, deer, turtles, and others.

•**Secondary Consumers**: feed on primary or primary consumables, and include organisms that eat meat called carnivores or (Carnivores) Carnivores

• **Triple Consumers**:feed on secondary consumables, and include organisms that eat carnivores such as eagles and large fish.

Top Consumers : occupy the top of the food chain, called top predators (Apex Consumers), which are the most powerful predators that feed on other consumers, and their nutrition is usually limited to the third food level.

3-3 Analysts

Known as sweepers or analyzers (Detritivores & Decomposers), they are living organisms that feed on dead plants and animals, or animal waste, examples of which are eagles and dung beetles. As for analyzers such as bacteria and fungi, they work to analyze the remains of living organisms after their death, thus converting organic materials into inorganic materials, and returning them to the soil to benefit from the products again, thus ending the food chain and completing the life cycle.

4- Food web

It is the overlap of a group of different food chains in the same organism and is known as the complex food web. And that energy is lost as we rise in the levels of the food chain to the top because living organisms consume the bulk of the energy they get from their food in the process of cellular respiration and energy is transferred to the surrounding environment in the form of thermal energy. The need for food is one of the characteristics of life, just like breathing, growth and reproduction. In fact, all kinds of organisms in our world – animals, plants, fungi, bacteria and algae in water – all need nutrients. Therefore, one of the most important interrelationships between living organisms is the relationship between the organisms that are eaten and the organisms that eat them.

5- Ecological Pyramids

It is a geometric representation that represents the flow or transfer of energy at successive nutritional levels in nature and in an ascending manner, where energy is reduced at successive levels.

Environmental pyramids are a means of determining quantitative relationships between organisms and are thus different from food chains and food webs by quantifying relationships.

In the pyramid, the products are usually at the base of the pyramid, then the primary consumer and then the secondary consumer, but the consumer does not mean one type of neighborhood.

The same organism may have a number of pyramids that vary by season, age, or geographic region.

5.1 Environmental pyramids and their types

Pyramid of Biomass

Pyramid of Number

Pyramid of Energy

a.Numerical Pyramids

In numerical pyramids, the products are always at the base of the pyramid, and then the first consumer comes, then the second consumer, and the mass does not enter into the calculation at all (the number only), that is, the small plant is equal to the large plant.In numerical pyramids, the primary products can be many types of small plants that are the base of the pyramid. As we move towards the top, the numbers are reduced, the sizes are increased and the species are reduced. The shape of the pyramid of numbers varies greatly according to regions, communities and seasons, as well as the quality of living organisms present in the ecosystem. For example, productive individuals may be small, such as plankton and plant rodents in water bodies in ponds and lakes, or they may be citrus and oak trees in forests.

b.Biomass Pyramid

The amount of living matter at a certain stage of the pyramid, where the mass is the largest at the base and decreases as we rise to the top of the pyramid, is an engineering model of the interactions and relationships between the food levels based on their weights (dry or soft weight). It is a more accurate expression of what is happening in the ecosystem regarding the flow of energy and its storage in the form of a living mass. The resulting shape is often close to the pyramid and helps if the size of individuals is homogeneous. The main factor causing the differences is the weight of water in living organisms, so it must be determined whether the weight is wet or dry and the calculation is one of them for all levels.

. Mass pyramid units kg /m2/year or g /m2 /day

C- Power Pyramid

The energy pyramid differs from the numerical or mass pyramid in that it does not express the size, weight or number of organisms in the ecosystem, while it expresses the energy storage or energy passage rates in the food chain. When all energy sources and pathways are taken within the food chain, the pyramid is always in a correct position.

Characteristics of the Energy Pyramid

1- The pyramid has a wide base followed by levels with slightly lower values, which gives the pyramid a correct or normal gradient.

2-Energy expended for breathing purposes is not counted in these pyramids

3-Sometimes a rule is added to the pyramid, which is the solar energy consumed by plants

4-Units of the energy pyramid are : its price\m2 \year or kilo its price \m2 \year or kilojoules \m2\year

6- Productivity

When following the flow of energy within the ecosystem, it is noted that it is used to convert elements into complex compound and molecules. Once the energy is dispersed, the elements are released again. As a result of this process, different organic compounds are formed that act as a store of energy and elements within the ecosystem. This production is called biological productivity. Biological production is distinguished from chemical or industrial production by the fact that the former is a continuous process while the latter is the function of the end of the reaction. Bio-production is divided into :

6-1 Raw Primary Productivity :

The amount of organic matter produced by producers during a given period of time represents a given area or volume.

6-2 Net Primary Productivity :

Represents the amount of organic matter produced that can be used by consumers,

6-3 Secondary Productivity :

Represents the amount of organic matter provided by consumers.

The biomass and productivity within the ecological pile are represented in the form of pyramids, where each food level (the producers below) is represented by a rectangle whose length is proportional to the magnitude expressed in the study, while its width remains constant.

7-Key factors affecting productivity

(a) On land ecosystems :

Light, temperature, precipitation

(b) On water systems :

Light, availability of nutrients

8-Productivity measurement Methods

1- Harvesting method.
2-Oxygen measurement.
3-Measuring carbon dioxide.
4-Measuring the acidic function (pH).
5-Radioisotope measurement.
6-Aluminum.
7-Chlorophyll Metering

Calendar

Application 01 :

(1)Define the following terms : Food Chain – Food Network – Producers – Grade Consumers -I Grade
Consumers - II Grade Consumers – III Analysts.

(2) Within food webs, do organisms maintain the same level in all food chains they enter ? Illustrate the answer with an example.

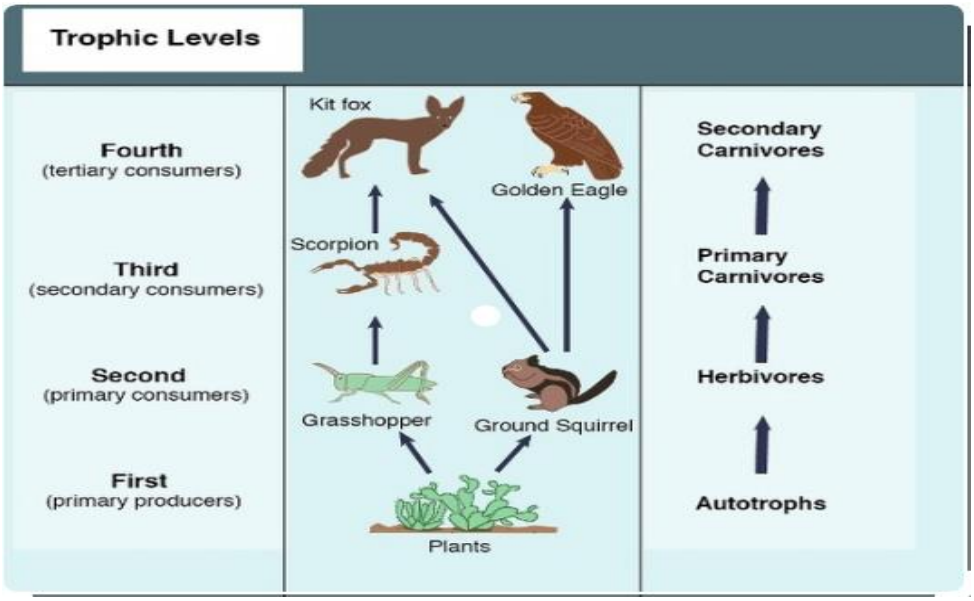
(3) The pyramid of numbers or the pyramid of individuals Pyramide des nombres is a graph that expresses the change in the number of individuals from one level to another within the food chain The pyramid of numbers is completed after choosing an appropriate ladder that represents all or most of the levels of the pyramid without completing the pyramids of numbers Give a suitable ladder for each of the five food chains represented in the table below:
We code for product P and consumer I (C1) and consumer II (C2)) and consumer III(C3)

Chain 1	Chain 2	Chain 3	Series 4	Series 5	
--------	--------	.	5	----------	C3
4	10	42.10	310	10	C2
200	50	52.10	510	1500	C1
3000	45.10	32.10	710	30000	P

(4) What do you notice about Series 3 ?
(5) Completed a diagram showing the transitions of the substance between different trophic levels.
(6) Whatdoes this scheme know ?

Application 02 : Food web

concept : the food chain



Based on this document, define the food network

The food relationship between the various organisms within the environmental funnel sometimes has a complex character according to the diet (grass – carnivorous – omnivorous) of the constituent elements of the rings, as prey is not always consumed by one type of animal, and so the same organism can contribute to overlapping food chains, thus forming a food network.

Quantitative study of food webs.

The intervention of organisms in a food chain varies not only in quality but also in quantity. This quantity can be measured in different ways :

• The number of individuals within each environmental loop.

• The value of the biomass (Biomasse), which is the mass of the living material of the organism in a specific place and time (t/ha.g/m2)

• The amount of energy provided by each living mass in KJ, for example.

(a) Biomass pyramids and energy pyramids :

Table 1 and Table 2 represent some links of two food chains

Table 02		
The rings.	Living Mass (g)	Energy (kj)
Owl	1.6	9.69
Plans	10800	18960
Insects	240	1429
Insectivore	20	121

Table 01		
The Episodes	Living Mass (g)	Energy (kj)
Owl	9.6	58.18
Plants	5400	9480
Rodents	120	727

1)-Give the appropriate food chain for each table.
2) -How can this biomass and energy be represented in a food chain graphically? Give this representation.
3)-Where do green plants derive their energy from? And what happens to matter and energy through the links of the chain ?
4)- Give a production-friendly formula for live mass. Then calculate the production friendly yield of the live mass in series 1 :
R1 : between producer and consumer I
R2 : Producer and consumer II
What do you conclude from these obtained values ?
(5)- How do biomass, energy, and production friendliness change across the chain loops ? How do you explain that ?
(6)- Calculate the total friendly yield for biomass production in each series
(7)- How do you explain the difference in terms of total wormhole relative to the two strings?
(8)- What do you conclude about the relationship between the total wormhole of biomass production and the number of rings in the chain?

TD07 : Biochemical cycles

The exchange of matter and energy is the main reason for the occurrence of interrelationships between the elements of the geographical atmosphere, which leads to the continuous movement of these elements as a result of the influence of a set of biological and non-biological processes, especially the process of photosynthesis. Thanks to the delicate balance of the cycle of natural elements and components, all elements found in nature are found within the framework of a biogeochemical cycle, including elements and gases found in air , water , and soil , as well as various wastes. The biogeochemical cycles explain the movement of nutrients in ecosystems and the difference between the speed of energy and the movement of nutrients. The elements move in the form of cycles from one nutritional level to the next. These are known as biogeochemical cycles. As for energy, it does not take the form of cycles because there is a source that supplies the earth with energy from the beginning of its formation, which is the sun, but there are no sources that supply the earth with elements or foodstuffs.

Two basic cycles of natural elements can be distinguished :

1. The Grand Cycle :

It is called the geological cycle, and it is a long-term cycle that takes place very slowly and lasts hundreds of thousands or millions of years, during which some compounds are migrated and accumulated in the rocks of the earth's crust in the form of coal, oil, limestone, and others.

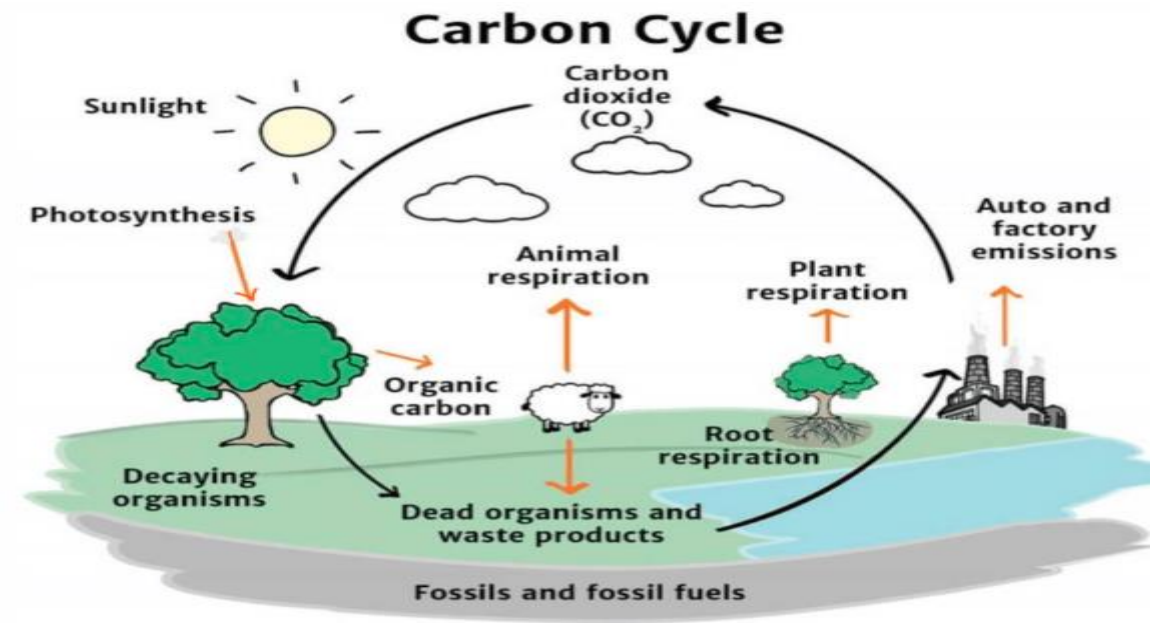
2- Minor Cycle :

It is called the biochemical cycle, and it is part of the major cycle, and it is summarized that the organic materials found in water and soil accumulate in plants, and are consumed in the construction of the living body, and after its death, the microorganisms of bacteria, fungi, simple organisms, and others analyze these dead bodies, dismantle them, and convert them into organic materials that re-enter the natural cycles.

The most important of these minor courses are :

2.1 Carbon Cycle :

Carbon is transported from the atmosphere to the earth, plants and living organisms, and carbon has great benefits. It is considered the basic building block in the synthesis of many important living elements such as glucose, and at the same time, when it is in the form of carbon dioxide, it is considered one of the most prominent pollutants of the environment.



Document (01) : Carbon Cycle Diagram

Through document (01) summarize the most important stages of the carbon cycle

Q : Why is carbon important in humans ?

Because it is included in the composition of foodstuffs, including sugars, fats and proteins

Q : In what form is carbon in the atmosphere ?

CO2

Q : How do organisms get carbon ? Plants take carbon dioxide from the atmosphere. As for human and animal consumables, they are obtained by eating plants

Q : How much carbon is in your body ?

It makes up about 18% of your body

Q : How does the carbon cycle work ? Through the document (01).

1- Plants take carbon from the air, which uses it for photosynthesis.
2- Carbon moves from the plant to the herbivore and from there to the carnivore.
3- During the breathing process, these organisms burn carbon-rich food for energy.
4- Breathing results in the release of carbon dioxide back into the air.
5- The analyzers also release more CO2 while analyzing and dismantling dead organisms.
6- Animals and plants buried deep in the ground turn into fossil fuels.
7- When humans extract and burn fossil fuels, the carbon dioxide stored in them is released.
8- The carbon cycle is divided into a long-term cycle and a short-term cycle (mentioned earlier) based on the duration of the two processes. The long-term cycle takes thousands of years to occur, and the carbon resulting from the short-term cycle is stored for a long time before it is released, and carbon enters this cycle when living organisms are buried deep in the ground.

Q : Whatare fossil fuels ?

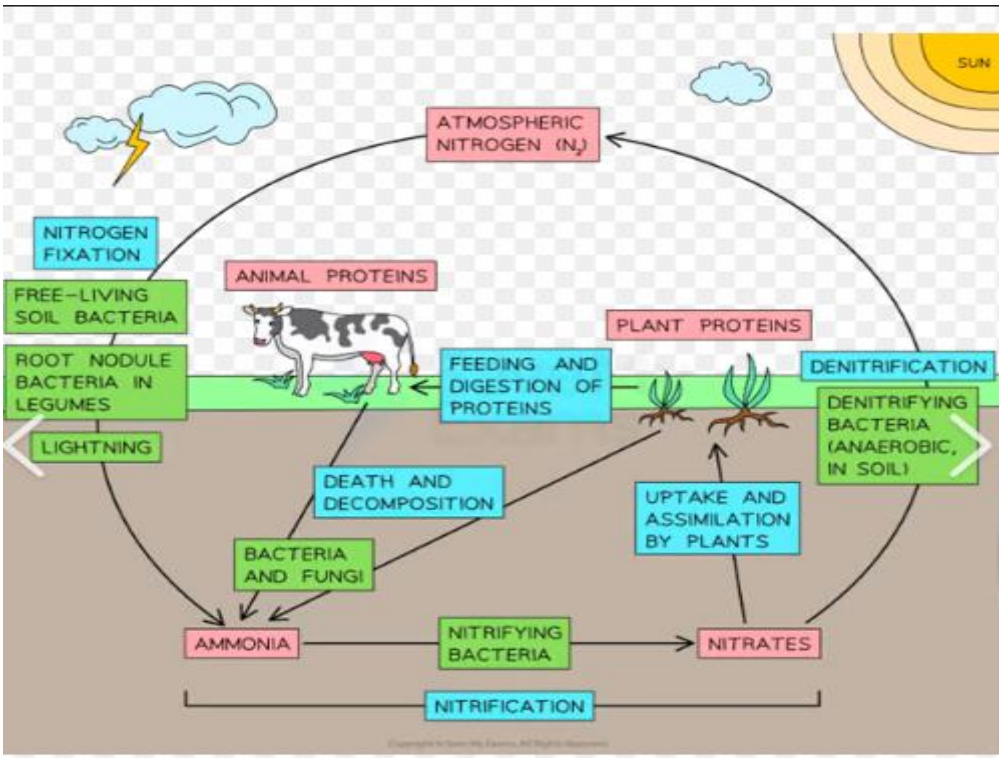
Oil - Gas - Coal

Result : Thus the phases of the carbon cycle include :

- photosynthesis
- Degradation
- Breathing
- Combustion

2.2 Nitrogen cycle

The nitrogen cycle is more complex than the oxygen and carbon cycles, as it does not enter the processes of respiration and photosynthesis, as living organisms (produced and consumed) can benefit from it freely only if it is in the form of nitrate compounds or ammonium compounds dissolved in water. The reason for this is that the nitrogen molecule is chemically inactive because it contains three bonds (N≡ N). Such three bonds do not allow nitrogen to combine with another element easily unless significant energy is used to break down these bonds. But some types of bacteria are able to do so and the process of converting free nitrogen into nitrogen compound (nitrate salts, ammonium salts and in small amounts of ammonia) is called nitrogen fixation (Fixation).



Document (02) : Diagram of the Nitrogen Cycle in Nature

Q : Where is nitrogen found in living organisms ?

In proteins that build bone, muscle, skin and blood

Q : How is nitrogen fixed in the cycle ?

By bacteria, lightning, and combustion.

Q : How much nitrogen is in the air ? 78 %|

Q : Mention five nitrogen compound that enrich the soil with nitrogen when it decomposes ?

1. Plant 2. Dead animals 3. Animal fur 4. Animal feathers 5. Bird waste such as pigeons.

Q : Mention the role and importance of each of the following

1. Lightning and thunderbolts for plant

It converts nitrogen into nitrogen dioxide and then nitrate compounds so that the plant can absorb nitrogen in the form of nitrates and benefit from nitrogen compounds to build its structure.

2. Bacteria in nitrogen fixation

Rhizobium bacteria convert nitrogen into ammonium and convert ammonium to nitrite and then to nitrates. The plant absorbs nitrates and ammonium [bio-stabilizes nitrogen] and makes use of nitrogen compounds to build its structure.

Q : Summarize the nitrogen cycle ? Through document (02)

1- Bacteria attached to the roots convert nitrogen gas into ammonia.
2- Soil bacteria convert ammonia into nitrite and another type of bacteria converts nitrite into nitrate.
3- It is then absorbed by plants through their roots.
4- Animals eat plants containing nitrate.
5- Animals excrete waste, including nitrogen.
6- Nitrogen returns again to the soil, and bacteria convert it back into ammonia.

Result : Nitrogen Cycle

79% of the atmosphere is composed of DNA, RNA and amino acids
In order for a plant to benefit from nitrogen, a process **called nitrogen fixation** must occur.
Nitrogen **fixation :** Converting nitrogen into ammonium compounds (NH4) and nitrate compounds (NO3-) so that the plant can absorb and benefit from it.

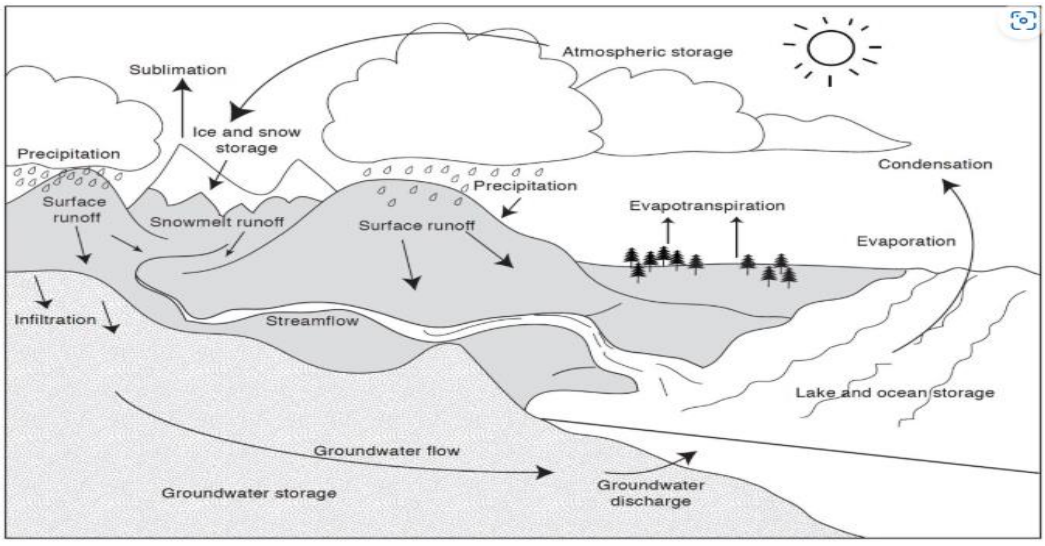
Bio-nitrogen fixation (nitrification) : Ribosium bacteria convert nitrogen in the soil to ammonium (NH4 +) and converted by other bacteria to nitrite (NO2-) and then to nitrate (NO3-) by another type of bacteria for absorption by the plant.

Nitrogen fixation by lightning and Thunderbolts : Converting nitrogen in the atmosphere by lightning and thunder into nitrogen dioxide and then nitrate ions (NO3 -) the plant arrives with rain to absorb it

Centrifugation : The opposite of nitrification, where anaerobic bacteria convert nitrates ((NO3-) to nitrite (NO2-) and then into nitrogen gas rising from the soil to the atmosphere, closing the nitrogen cycle.

3. 3 The Water Cycle

Water **is** an important element for life on Earth, as plants, animals and humans rely heavily on it to continue living. Water is either in the form of vapor in the air, liquid water in rivers, lakes, seas and oceans, or frozen in the form of ice at the poles. The amount of water in the oceans is estimated to be about 97% of the amount of water on the surface of the Earth.



Document (03) : A diagram of the water cycle in nature

Q : What is the water cycle ?

It is the continuous movement of water between the surface of the earth and the air, during which it turns from the liquid to the gaseous state and then to the liquid state again.

Q : What is evaporation ? What is condensation ?

Evaporation : Liquid water is transformed into gas due to heat .Condensation : Gas turned into liquid due to cold.

Q : What is the water that is exposed to the heat of the sun ?

The waters of ponds, lakes, seas, oceans, and rivers absorb the heat of the sun and begin to evaporate.

Q : When does evaporation increase ?

The higher the temperature.

Q : How does the water cycle work ?

1- Seas, oceans, lakes and rivers evaporate due to the heat of the sun.

2- Vapor rises in the atmosphere where it cools.

3- When water vapor cools, it begins to condense in the form of liquid water droplets.

4- Water droplets gather and form clouds, and when the droplets become heavy, they fall in the form of precipitation.

Q : What does precipitation look like after it lands on the ground ?

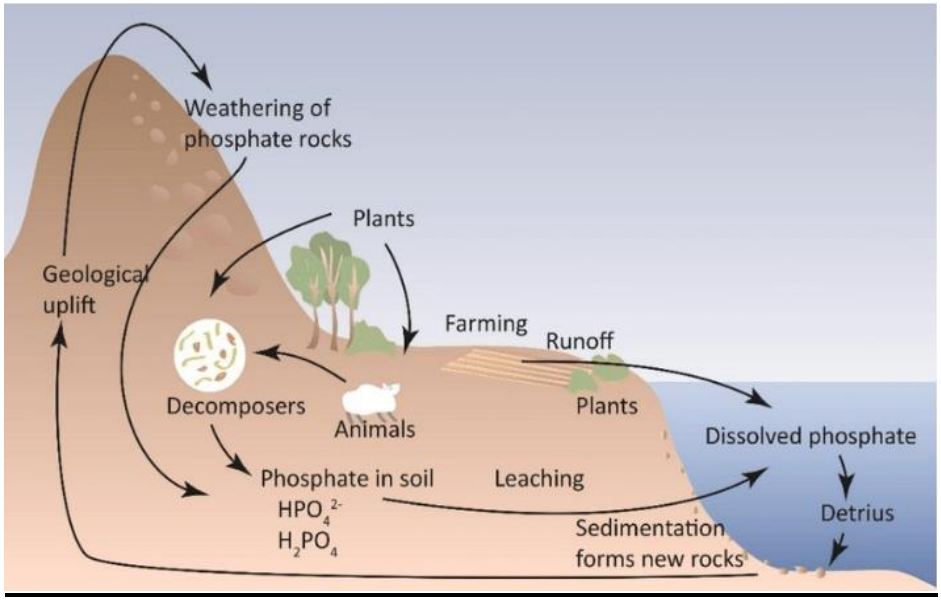
1- Part of it collects on the surface of the earth called surface water.

2- Part of it flows through valleys and rivers and empties into seas and oceans called running water.

3-The other part enters the ground and is called groundwater

3. The Grand Cycle : Example of the Phosphorus Cycle

The phosphorus cycle differs from the cycles of passing elements in that the atmosphere does not form one of its reservoirs. It is found in the Earth's crust as a phospha-t-shaped element, where 4 atoms of oxygen combine with one atom of phosphorus to form a phosphate ion, which in turn combines with a positive ion such as calcium ion to form the mineral antite (calcium phosphate), which is found in many rocks of the earth's igneous and sedimentary crust. When phosphate-containing rocks roam, the phosphate ion is transferred to water and then to plants (products) through the soil. and then to organisms (consumables), where it becomes a key component of cell membranes,DNA, RNA and ATP



Document 04 : Outline of the Phosphorus in Nature Cycle

Through document (04) : Summarize the stages of the phosphorus cycle :

- Annual flow of phosphorus through erosion mechanisms and agricultural fertilizers.

2- The seabeds and stations are the main reservoir of phosphorus, and this quantity remains constant due to the substitution of molecules

Inorganic phosphorus is the first hydrolysis of organophosphorus compound.

3- Consumption of plants by large animal organisms or after their death, they turn into inorganic phosphorus.

4- Non-plant biota that secrete dissolved organic phosphorus compounds and that bacteria adhere to these compounds and release other phosphate compounds.

5- Waste decomposition from different industrial sources resulting in phosphate compounds.

6- Deposition or persistence of phosphorus particles at the bottom or through mixing dueto erosion.

Eutrophication is a term that expresses the state of the nutritional richness of the water body when it receives large amounts of water, which leads to the flourishing of algae as well as increased growth of water, which makes water bodies unsuitable for swimming.

Calendar

Q/ What is the importance of biogeochemical cycles

We conclude from the biogeochemical cycles of the elements that the materials within the ecosystem are finite, constantly reused and recycled in contrast to the flow of energy. On this basis, we consider the ecosystem for the movement of materials a closed system, as the materials are recycled to be used several times. Since the materials on the Earth's surface are finite, whenexploiting them we must use them in a rational way, so that they are constantly recycled. If we do not use them well, this leads to the cycles becoming unbalanced (i.e. not recycled), which leads to their accumulation, and then they are called pollutants, and this applies to every element or substance. In general, we can benefit from our study of the biogeochemical cycles of the elements as follows :

- Know the warehouses in which the item is stored.
- Knowledge of the processes that link warehouses.
- Know the paths followed by the item in its movement from one warehouse to another.
- Predict the rate of movement of the item in the course.
- Predicting the process of an item entering or missing a course.
- To know the shapes in which the element is located.

Q/In which parts of the environment can we find carbon ?

c/Rocks and minerals, ocean dissolved carbon compounds, atmospheric carbon dioxide (CO2), organic compounds in living organisms, carbon in rocks and minerals, and carbon in atmospheric dissolved carbon compounds. Carbon is one of the most important elements in the periodic table, and without this element it would be difficult for all living things to survive.

Q/Why is the carbon cycle important for living organisms ?

c/The atmospheric carbon dioxide balance is maintained by the carbon cycle. To sustain life as we know it and control the Earth's temperature, this is essential. Besides, the carbon cycle is responsible for many other processes such as photosynthesis, combustion, and respiration that are essential to the functioning of this world.

Q/What are some human activities that have negative impacts on the carbon cycle ?

A/There is an imbalance in the carbon cycle as a result of activities including deforestation, burning of fossil fuels and industrial processes. Students can think more about the nature of these activities and the type of negative effects they cause by disrupting the carbon cycle.

Q/Causes/Nitrogen is the most common element within the biosphere ?

C /- Because its concentration in the air is 78% of the air.

- The plant can only benefit from free nitrogen in the form of compounds in the soil through nitrogen-fixing bacteria.
- It is found in the soil in the form of Nitrate or Ammonia.
- Organic materials can decompose after the death of living organisms or decompose urea or excretory products in which nitrogen is returned to nature again.

Q/Ways in which nitrogen compounds are decomposed

1- Mycobacterial decomposition, 2-rhizobium bacteria, 3-physical fixation of nitrogenous compounds (by lightning and thunder) 4- volcanic action and nitrogenous fertilizers.

Q/Illnesses/Nitrogen maintains correct levels of plant food raw materials without excessive accumulation of ammonia products in the soil ?

C/ Because of the delicate balance of the action of types of bacteria, as this balance leads to the periodic flow of nitrogen through all parts of the ecosystem

Q/Illnesses/ **The nitrogen cycle is complex and stable at the same time ?**

A/ Because each stage is biologically controlled (bacteria and plants) and not biologically like natural phenomena such as lightning, thunder and volcanic action

Q/Reasons/The phosphorus cycle is one of the sedimentary cycles ?

A/ Because the materials move from land to water and then return to land again, where phosphorus arrives from phosphate rocks due to erosion factors as well as bird and fish residues and animal deposits to water and then to the oceans and is deposited at the bottom of the ocean and is deposited at the bottom of the shallow sea and near the coasts.

Q/What is the importance of phosphorus for living organisms ?

C/1- An important element for living organisms that plays an important role in every step of the organic structure.

2- Participates in the synthesis of nucleic acids.
3- It is found within the structure of the cell's organic compounds such as phospholipids.
4- It enters into the installation of three-energy vehicles.

Q/What are the sources of phosphorus in nature ?

1-Phosphate rocks 2- Bird and fish remains 3-Fossilized animal deposits.

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