Ecology and Pollution

First Lecture

The objectives of the lecture
Definition of ecology, when this science originated, and its relationship to other sciences

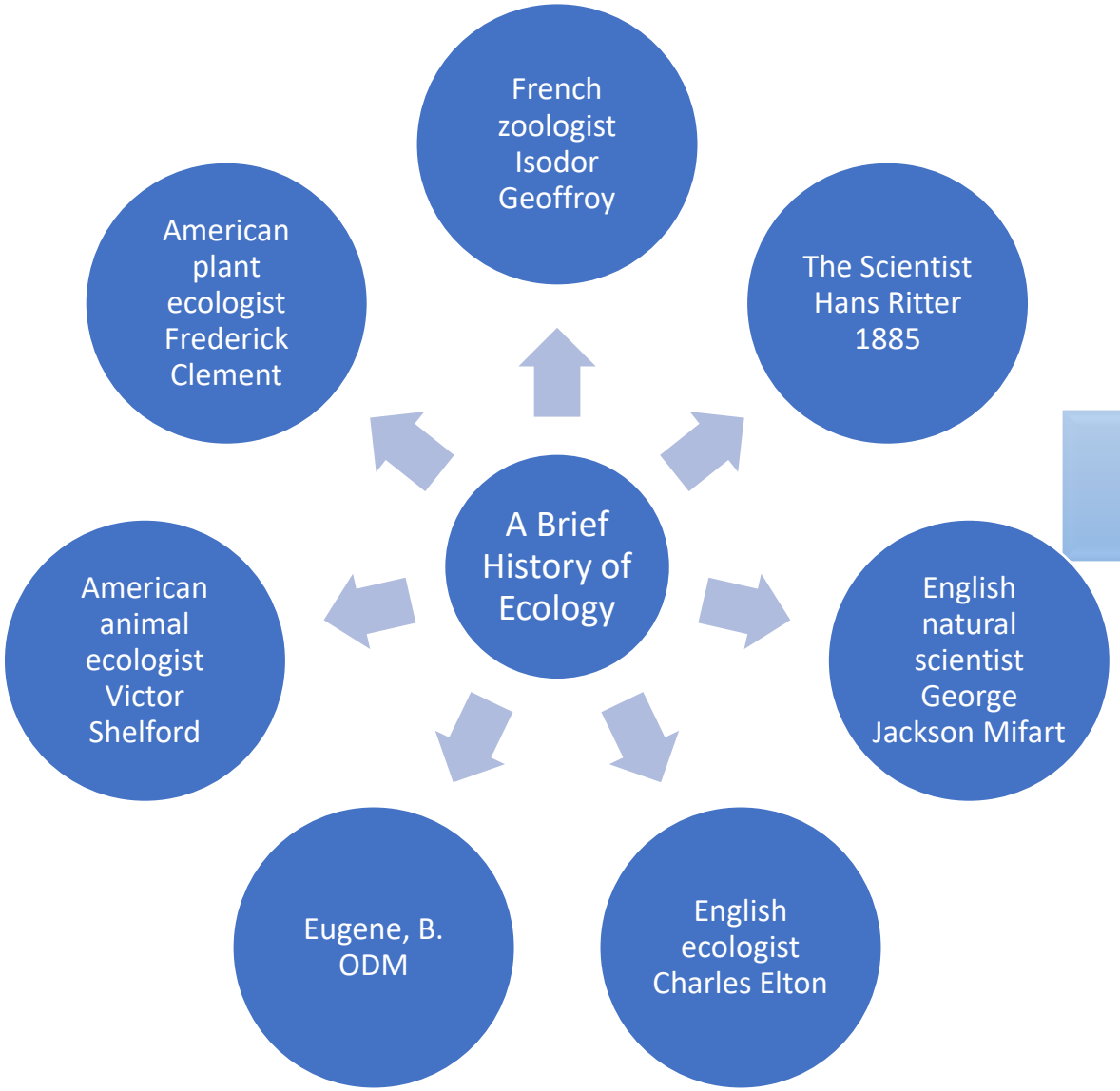
Definition of ecology

The ecology can be defined as the environment that surrounding humans, which includes all material and non-material aspects, human and non-human, and this means that the environment means everything that is outside of the human being, as it includes the assets that surround them. So, the air that a person breathes and water that he/she drinks, the land on which he/she lives and cultivates it, and all that surrounds him/her of living creatures, or inanimate objects, are the elements of the environment in which he/she lives, which are considered the framework in which they practices their life and its various activities.

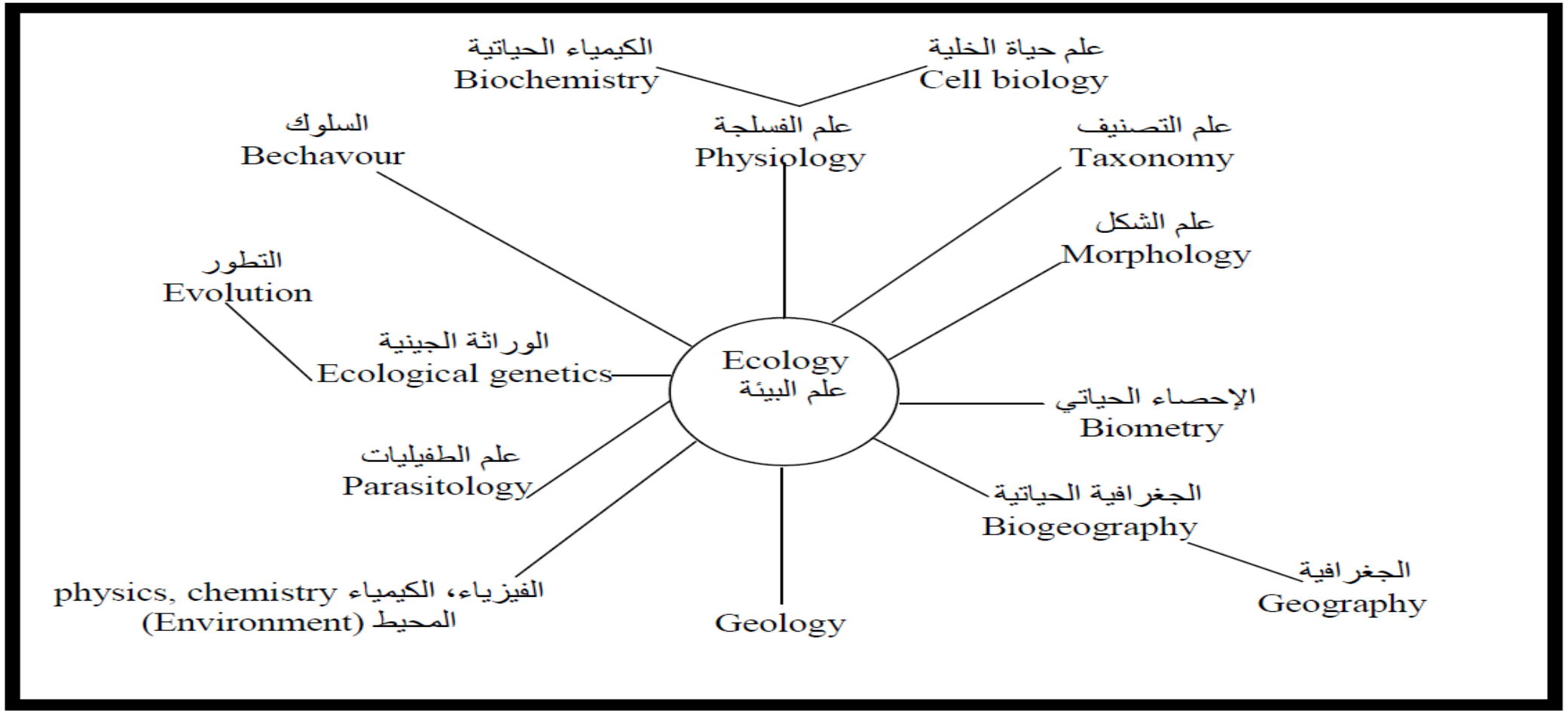
Introduction to ecology

Thomas Cohen in 1970 put forward a meaningful suggestion that the advanced scientific system could represent the connection of several separate roots that lack the initial one. If we set aside these considerations, we will find that the introductions to modern ecology certainly extend to the genesis of man kind. Our ancestors learned a lot about the environmental that surrounding them, and they were able to observe the natural surroundings of all assets and trace them until they reached ancient civilizations, especially the subjects of agriculture and the marine world. In fact, there are many evidences about the ancient Greeks' formal taxonomic study of the environment during the third and fourth centuries B.C.. Distinguished ecologists such as Aristotle and his student Theofer Augustus, whose history of scientific observations of nature continued after him until it reached the nineteenth century. Here, observations were noticed by historical scientists who have been concerned with the observation of nature, such as Pavon, Linnaeus, Remor, Darwin, as well as von Humboldt and many others to this day.

Historical overview of ecology



علاقة علم البيئة بالعلوم الاخرى



The factors that led to the development of ecology

6. New problems arise

5. Astonishing broad industrial progress

4. The great advancement of means of transportation and communications

3. The spread of poverty, disease and famine

2. Decreased vegetation cover

1- The problem of overpopulation in the world

Methods of preserving the environment


Thank
you!

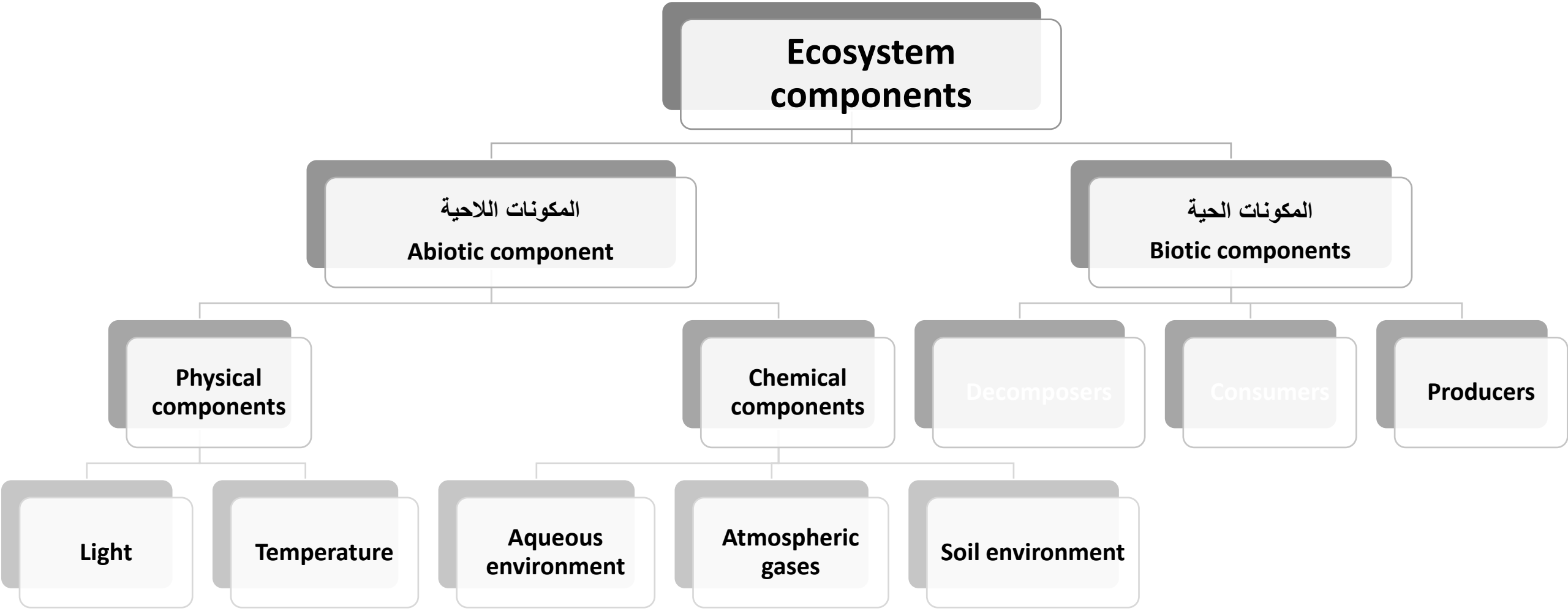
ECOLOGY AND POLLUTION

Second lecture

The objectives of the lecture
Defining the ecosystem and clarifying the components of the ecosystem

The ecosystem

An ecosystem is defined as a community of different living things (a community of plants, animals, and microorganisms) that live and interact with each other in a specific place such as forests and lakes in order to achieve the flow of energy and create food chains.


Ecosystem components
المكونات اللاحية
Abiotic component
المكونات الحية
Biotic components
Physical components
Chemical components
Decomposers
Consumers
Producers
Light
Temperature
Aqueous environment
Atmospheric gases
Soil environment

Biotic components المكونات الحية

Producers المنتجات

They are the organisms that have the ability to obtain their food without the need for help of other living organisms, by relying on non-living elements.

Consumers المستهلكات

These non-self-feeding organisms may be called heterotrophic organisms. These organisms depend for their food directly or indirectly on the productive organisms, so they are called dependent organisms for nutrition.

Decomposers المحللات

They are non-autotrophic saprobiontic or parasitic organisms. These organisms cannot devour and digest food, but rather absorb food after secreting digestive enzymes to break down food components into simple substances.

Abiotic components المكونات اللاحية

First: the chemical components

2. Atmospheric gases

The most important gases are (O2, N2, CO2). Oxygen is present in the atmosphere at a rate of about (19-20)% and in the lower layer thereof and up to a certain height above the surface of the earth in its free molecular form and then turns into the atomic form O at a height of approximately 50 Km.

1- Soil environment

It is one of the main components of the environment and sometimes forms the basis of any ecosystem as it is the source of many metallic and non-metallic elements, and it is the final state in the element cycles (K-Ca-P-S-C-N).

3- **Aqueous environment**

Water is an essential component of ecosystems and may constitute a separate ecological domain on its own. Its importance in terrestrial ecosystems can be summarized for the unique characteristics, in addition to its benefits as moisture in the soil and in the air

ثانياً: المكونات الفيزياوية

1. درجة الحرارة (Temperature)

An essential factor controlling all organisms' activities, such as proliferation, reproduction, hibernation, etc. This affects the ability of the ecosystem to continue to produce potential energy, or to decrease its production.

2. الضوءLight

It can be called solar radiation, as the light needed for ecosystems comes from the sun, and it represents the only source of energy for most of them, except those that live on chemical composition. Light controls plant physiology, as well as the behavior of plants, affecting their propagation in ecosystems.

Incomplete Ecosystems :الانظمة البيئية غير الكاملة

- Ecosystems that have all the basic components of an ecosystem (biological and non-biological components) are considered integrated ecosystems, but there are some ecosystems that lack one or more of these components, so they are called imperfect ecosystems. Among the clear examples of these systems that are found in the deep depths of the seas and oceans, as there are decomposing and consuming organisms, while there are no producer organisms due to the darkness because the light rays do not reach those depths, and the consumer in this case is composed of organisms that feed on fallen plants or dead animals from the upper levels.
- Among the many other examples of imperfect ecosystems are cave areas with complete darkness, as the producer does not exist for the same previous reason, and only the consumer and the analyzers are noticed

The Ecological balance

- Ecological equilibrium is the term that generally applies to the tendency of life systems to resist change and remain in a balanced state.
- Ecologists have agreed that any disturbance in the natural balance of any ecosystem is a type of pollution, which indicates that the environmental balance is important in the stability of the biotic and non-biotic components of that ecosystem.

THANK YOU

Third lecture

Environmental Pollution

College of Energy and Environmental Sciences

Aim of the lecture

Knowing the types of environmental pollution, what are the reasons that led to this pollution, and what are the suggested solutions

Environmental Pollution Definition

Any physical, chemical or biological change that leads to a harmful effect on the air, water or land, or harms the health of humans and living organisms, by affecting the state of renewable resources. Or it is the destruction or distortion of the natural purity of living organisms or inanimate objects due to external factors transported by air, water or soil. Another definition: it is every quantitative change in the components of the living or non-living environment that the ecosystems are unable to absorb without their balance being disturbed.

Types of Pollution

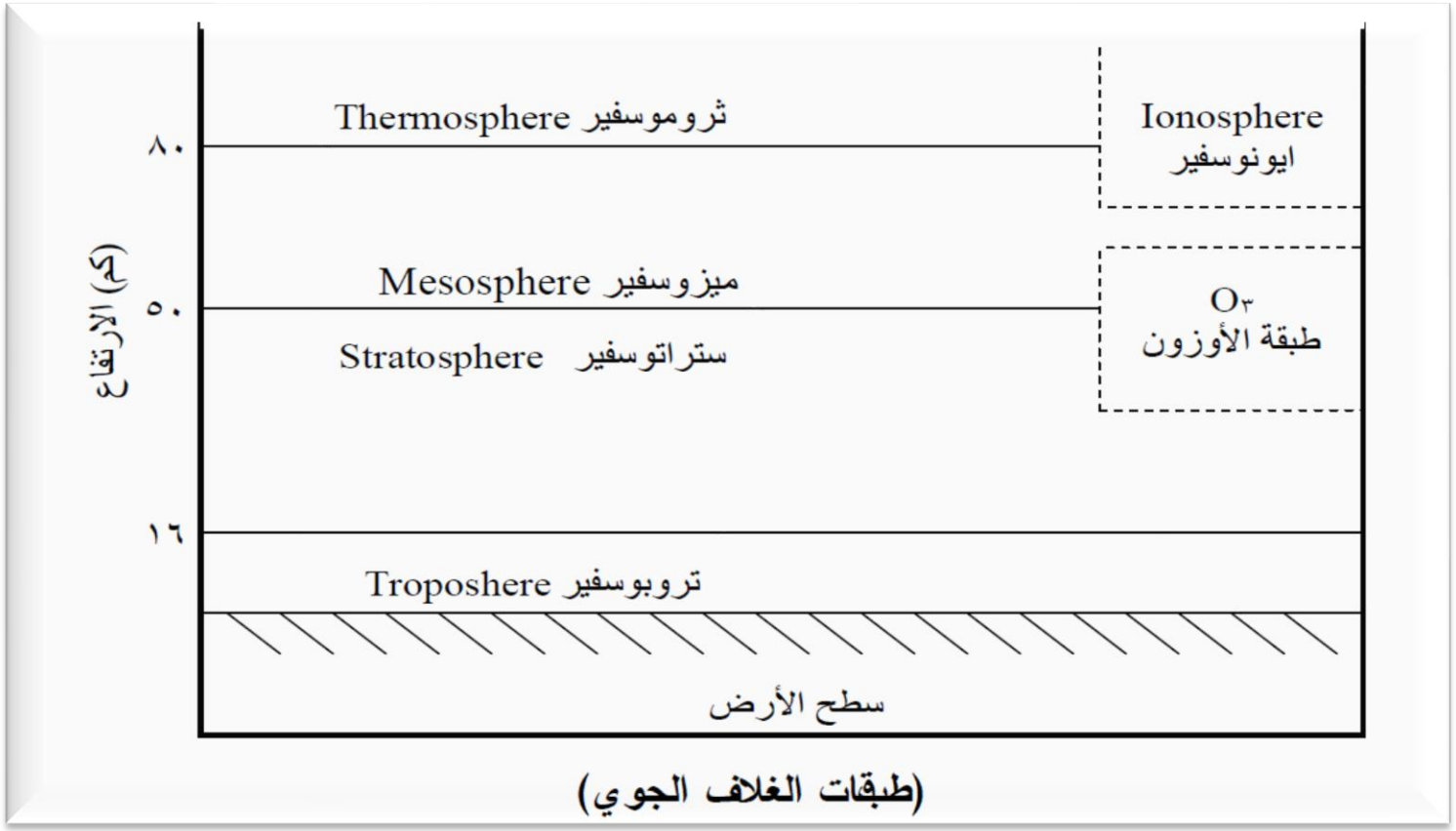
1. Air Pollution تلوث الهواء
2. Water Pollution تلوث المياه
3. Soil Pollution تلوث التربة

Air pollution

We all know that oxygen is the basic element in the formation of air for the life of humans, animals and other lower organisms such as bacteria, fungi, yeasts and viruses. In other words, all life forms will be affected with the change in the natural oxygen percentages in air, the most important of which is the effect on the life of these different organisms

That is, the air is considered polluted with any major change in its composition resulting from the increase of gases coming from the combustion processes of natural and synthetic fuels such as car fuels, electric power plants and coal in its various forms. In addition, the waste of cement, bricks, oil manufacturing plants, chemical factories, and other reasons lead to an increase in the percentage of the following gases and compounds:1- Carbon monoxide gas.2. Nitrogen oxides.3. Sulfur oxides.4. Oxidants.5. Hydrocarbon gases.6- Airborne dust and particles.

The Atmospheric Layers



(طبقات الغلاف الجوي)

Global Warming Phenomenon

- The phenomenon of global warming is defined as the temperature increases gradually in the of the lowest layers of the atmosphere surrounding the earth as a result of the increase of greenhouse gases (greenhouse gases). Most of the greenhouse gases consist of water vapor, carbon dioxide, methane, ozone, and nitrous oxide. The greenhouse gases are natural gases that play an important role in heating the surface of the earth, without it, the earth's temperature may reach between (15-19) degrees Celsius below zero. These gases absorb part of the infrared rays that are emitted from the surface of the earth as a reflection of the rays falling on the surface of the earth from the sun and keep it in the earth's atmosphere to keep the earth's temperature at its natural rate.

The most important greenhouse gases

1

CO_2 : This gas is produced from the combustion of fuels such as coal, petroleum, and natural gas. It is also produced from biological breathing and fermentation of sugary materials, as well as from garbage burning operations.

2

Methane (CH_4): This gas is produced from combustion processes and bacterial analysis of organic elements, especially in waste collection sites. When methane moves to the stratosphere, it decomposes into carbon and hydrogen, where carbon atoms combine with oxygen to form CO_2. As for hydrogen, it combines with oxygen to form water vapor.

Effects of Global Warming

1. The increase in ocean water's temperature during the last 50 years.
2. Decrease the presence of snow and snow thickness at the poles.
3. Sea level rise, which may threaten buildings, roads, power lines and other infrastructure.
4. The surface temperature of the earth has risen at a rate of one degree.
5. Increasing the length of the melting snow season and decreasing the duration of the freezing season.
6. The extinction of many types of birds and plants, due to the difficulty of adaption that live in freezing areas to the rapid rise in global temperature.
7. The high temperature leads to an increase in the spread of endemic diseases such as malaria and cholera due to the migration of the insects that transmit them from their places in the south towards the north.
8. An increase in arid lands and a decrease in agricultural productivity.

Solutions

1. Activating decisions to reduce pollution at the global level.

2. Planting trees and protecting forests, which is a matter that has an active and fundamental role in reducing pressure on major forests.

3. Expanding the use of clean energy sources such as solar and wind energy in industrialized countries to reduce emissions resulting from the use of regular fuels.

Acid Rain Phenomenon

- Acid rain consists of the reaction of sulfur-containing gases, the most important of which is sulfur dioxide with oxygen in the presence of ultraviolet rays from the sun, and sulfur trioxide is produced, which then combines with the water vapor in the atmosphere to give the sulfuric acid that remains suspended in the air in the form of fine mist carried by the wind from one place to another. But when the weather is dry, the sulfuric acid spray remains suspended in the air and appears in the form of a slight fog. When conditions are suitable for rain, it melts in the rainwater and falls on the surface of the earth in the form of acid rain. Here, nitrogen oxides share with sulfur oxides the formation of acid rain, where nitrogen oxides are converted in the presence of oxygen and ultraviolet rays to nitric acid. This acid remains suspended in stagnant air and goes down with rainwater as sulfuric acid, forming acid rain.

The effects of acid rain on the environment

The impact of acid rain in lakes and oceans

- The death and decline of many living organisms that live in these lakes, especially fish and frogs. Whereas, the acidity of the water is increased due to the transfer of sulfuric acid with the water of torrents and rivers after the acid rain.

The effect of acid rain in forests and plants

- The destruction of forests has a great impact on the ecosystem, it is noticeable that forest production accounts for about 15% of the total production of organic matter on the surface of the earth, in addition to the amount of wood consumed by humans is more than 2.4 billion tons per year. Acid rain also affects economic plants with seasonal crops and coniferous forests, as they strip trees of their leaves and cause an imbalance in the soil

The effect of acid rain on animals

- The safety of each component of the ecosystem depends on the integrity of the other components. For example, if plants are affected by acid rain, it deprives rodents of food and shelter, and leads to their death or migration. Crustaceans and small fish have also been observed to die in acidified lakes

Solutions

Due to the seriousness of the acid rain phenomenon and the disruptive effects that result from it on all levels, the researchers suggested two treatments. The first is an expensive and repetitive one, and due to the frequent occurrence of acid rain, as this method is represented by neutralizing rivers, acidic lakes and agricultural lands with alkaline substances. While the second is a permanent treatment, which is the purification of pollutants before they spread into the atmosphere, reducing fuel consumption in transportation, and finding alternatives that do not leave negative effects on the environment.

THANK YOU

Environmental Pollution

Fourth Lecture

The Ozone Hole (Reasons and Effects)

Ozone gas consists of 3 oxygen atoms, which is an unstable state of oxygen gas. Note that this gas is toxic to various forms of life. The ozone layer is part of the Earth's atmosphere, which contains intensely ozone gas. It is highly concentrated in the lower stratosphere of the Earth's atmosphere and is blue in color. Part of the oxygen gas is transformed into ozone by the strong ultraviolet rays emitted by the sun and affect this part of the atmosphere due to the absence of thick layers of air above it to protect it. This layer is of very importance to us, as it prevents the arrival of short ultraviolet waves in a large concentration to the Earth's surface.

Ozone Benefits

1. It kills microorganisms when exposed to it directly, especially harmful ones such as bacteria, fungi, yeasts, viruses and parasites.
2. Its use in some developed countries in the treatment of drinking water and sewage water and sterilization of foodstuffs before canning and packaging.
3. Its great benefit is in protecting the Earth from ultraviolet rays coming from the sun, as the decrease in ozone from the natural limit negatively affects humans, animals, and plants in the evolutionary ladder.

Reasons of the hole in the ozone layer

Damage caused by the attrition of the ozone layer

Radioactive Pollution

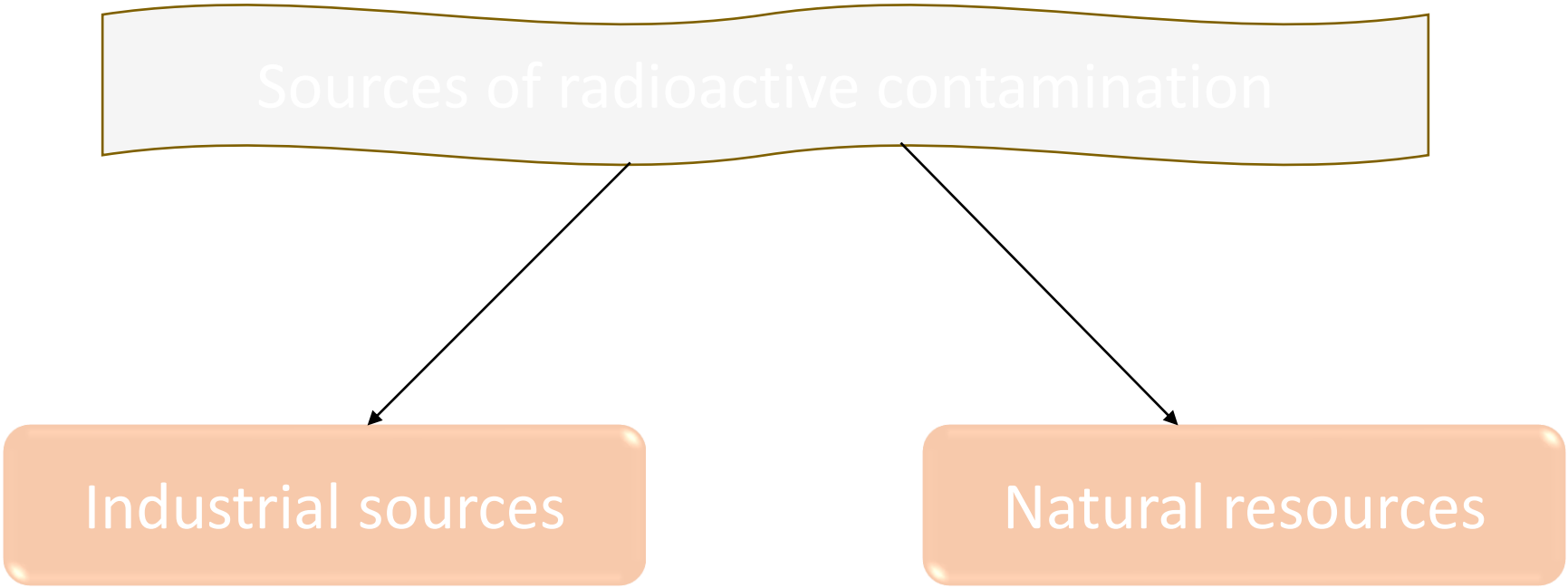
Radiation is a natural phenomenon that surrounds man everywhere in his daily life. Human activity has led to an increase in its concentrations in some locations, because of accidents, certain industrial problems, or mismanagement, which leads to serious pollution cases.

the damage that may befall the human body as a result of exposure to radioactive materials depends on several factors:

1 . The dose to which the human is exposed to these radioactive materials.

2 . The type of radiation.

3 . The time that the body is exposed to these radiations.


Sources of radioactive contamination
Industrial sources
Natural resources

First: Natural Resources

c) X-ray

It is protons that flowing out from the sun after the emission of fiery glows, part of these rays are large enough energy to cause changes on the Earth's surface.

b) Secondary cosmic rays:

It is the product of the interaction of primary cosmic rays with the Earth's atmosphere and consists of photons, electrons, protons and neutrons, and its intensity increases as we approach the surface of the Earth.

Primary cosmic rays: (a

It consists of 87% protons, 12% alpha particles, and 1% nuclei of heavy elements such as carbon, oxygen, nitrogen, calcium and iron. It is found at an altitude of 50 km or more, and its density decreases as we approach the surface of the Earth.


2


3


4

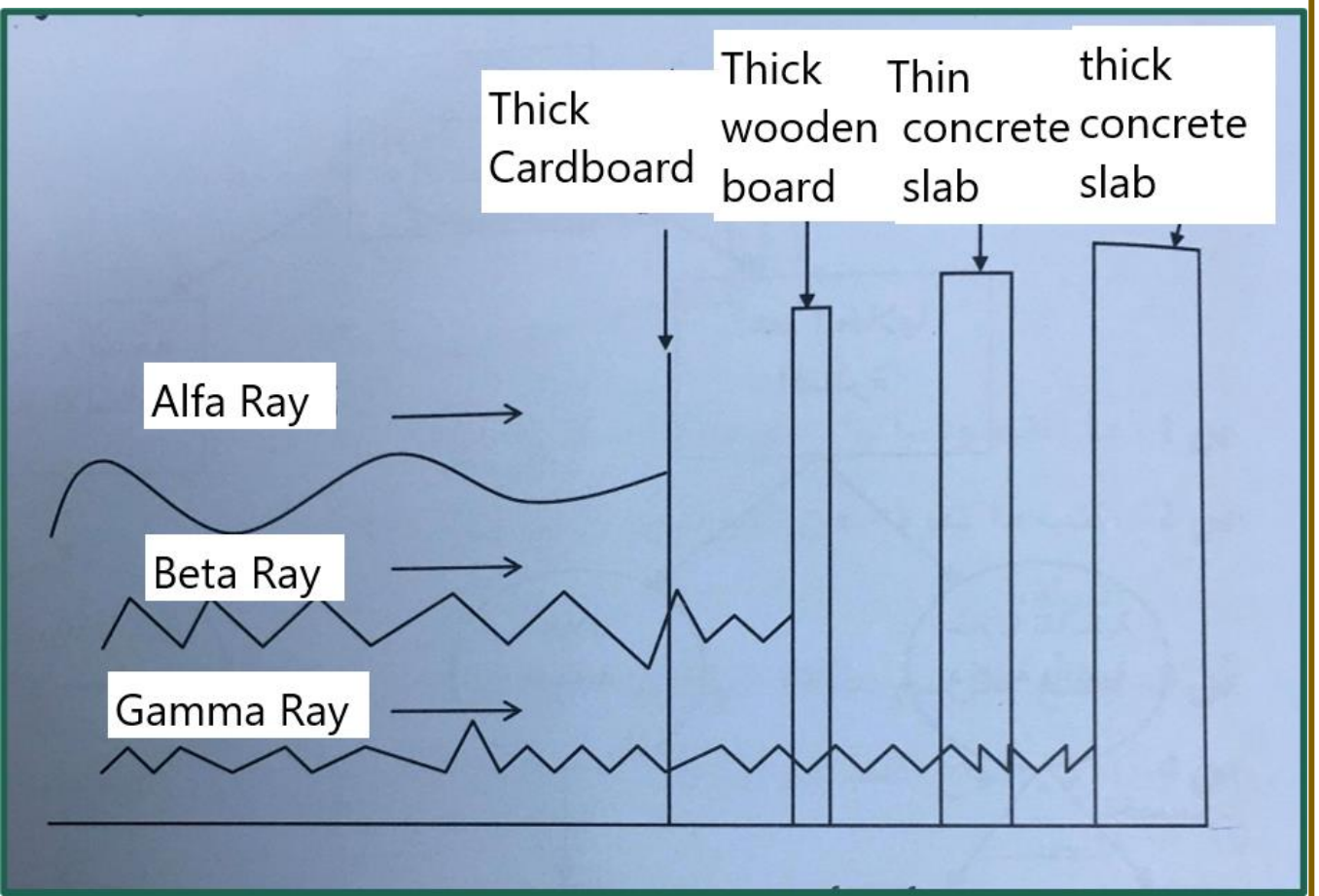
Second: Industrial Sources

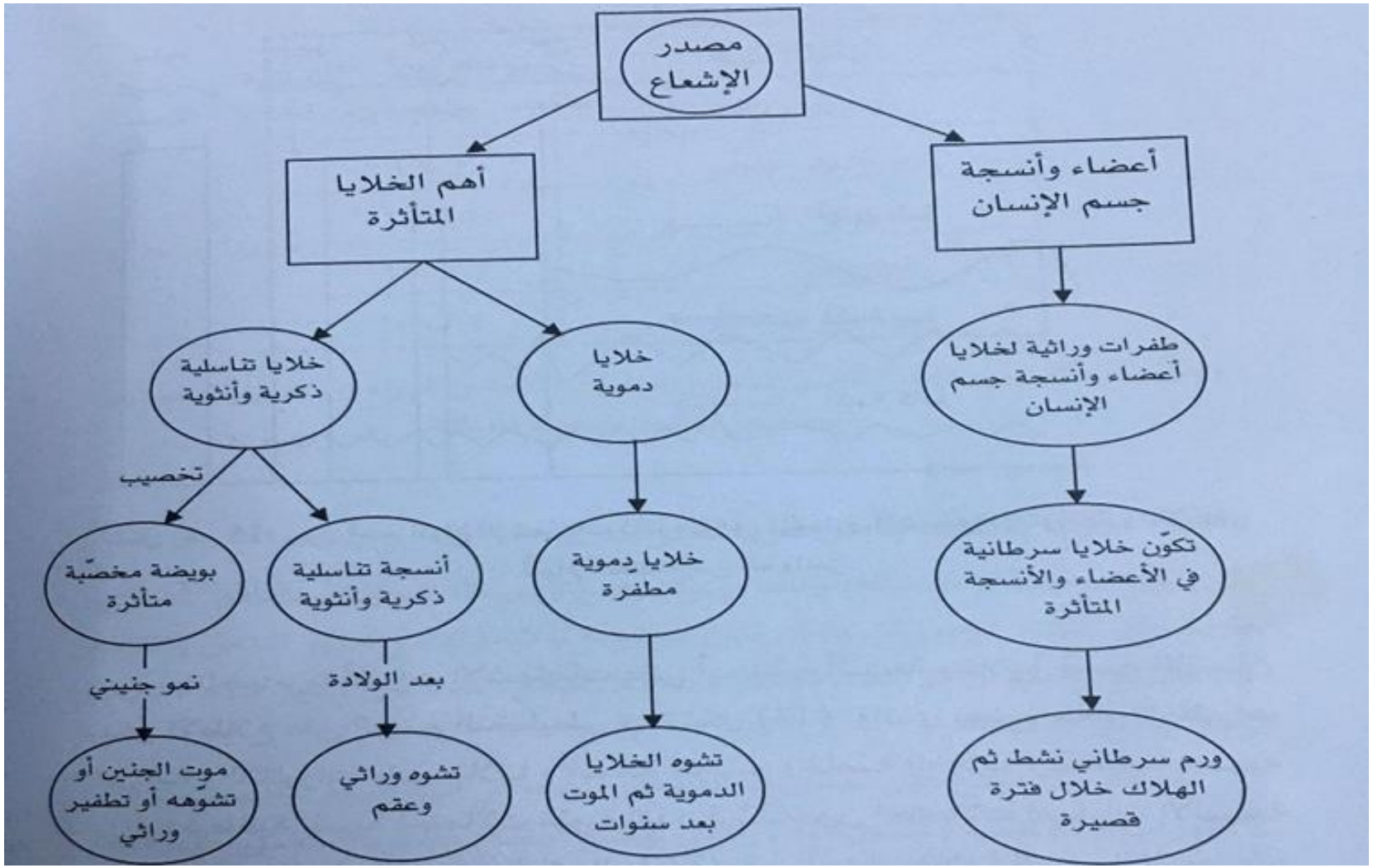
Biological effects of radioactive contamination

1. Somatic (subjective): These are the risks or effects that affect all types of somatic cells. That is, its symptoms or effects appear in the same organism that was exposed to radiation.

2. Genetic effects: The effects whose symptoms appear in the offspring of an organism that has been exposed to radiation.

The relationship of radioactive materials to cancer




مصدر الإشعاع
أهم الخلايا المتأثرة
أعضاء وأنسجة جسم الإنسان
خلايا تناسلية ذكرية وأنثوية
خلايا دموية
طفرات وراثية لخلايا أعضاء وأنسجة جسم الإنسان
تخصيب
بويضة مخصّبة متأثرة
أنسجة تناسلية ذكرية وأنثوية
خلايا دموية مطفرة
تكوّن خلايا سرطانية في الأعضاء والأنسجة المتأثرة
نمو جنيني
بعد الولادة
موت الجنين أو تشوّهه أو تطفير وراثي
تشوه وراثي وعقم
تشوه الخلايا الدموية ثم الموت بعد سنوات
ورم سرطاني نشط ثم الهلاك خلال فترة قصيرة


Thank You

Fifth lecture

Ecology and pollution

College of Energy and Environment Sciences

Water Pollution

Water is the complementary and important part of life and its continuity, just as life does not continue on the globe without air, it also does not continue without water. The amount of water on Earth’s surface is estimated at about 70%, or more than two-thirds of the land area. Rather, the amount of water in a living cell ranges between 75-90% depending on the type of the cell, and the amount of water in human’s body is about 78% based on the total weight of the body. Water in nature is exposed to the danger of pollution as a result of the increase in the proportion of natural and non-natural components beyond its acceptable limits, which leads to an increase in harmful effects on ecosystems, in which humans are the main and important part.

Physical and Chemical Properties of Water

It is necessary to talk about the basis for determining the quality of water in nature in terms of chemical, physical and biological specifications, which must be within specific and acceptable levels, and these specifications include:

1- Salinity

2- Electrical conductivity of water

3- pH concentration (acidity and basicity)

4- Biological need for oxygen

5- Dissolved oxygen concentration

6- Water color

7- Turbidity of water

8- The concentration of radioactive materials in the water

9- Harmful microorganisms

The main factors that lead to water pollution

Population density. 1

Density and distribution of industrial establishments and their proximity to a specific water body. 2

Technological development in industry, agriculture, medicine and other sciences 3

Human negligence to reduce pollution and not treating pollutants before throwing them into water bodies. 4

Types of Water Pollutants

There are many pollutants that change the physical, chemical or biological characteristics of water to make it unfit for known uses. These pollutants are:

1- Organic waste.

2- Industrial waste

3- Residues of the agricultural process.

4- Thermal pollution.

5- Oil pollution.

Water Pollution Indications

Water pollution is defined as a clear change in the physical, chemical or biological properties of water so that it becomes unfit for use by humans and does not constitute a suitable environment for the survival and reproduction of living organisms. There are a number of phenomena that indicate water pollution are:

1- Lack of dissolved oxygen.

2- An increase in water temperatures.

3- Increase of soluble nutrients.

4- Increased cloudiness and its effect on light permeation.

5- Presence of toxic waste in the water.

6- Bottom properties change.

7- Undesirable production or growth of aquatic organisms, ie nutritional enrichment.

8- High bacterial content, and the presence of parasites, so that they are a source of epidemics and diseases.

9- An increase in the concentration of dissolved salts in water.

Oil Pollution

Oil pollution is one of the most noticeable pollutants in the oceans and seas. Water pollution with oil results from the leakage of petroleum oils and its derivatives into the water as a result of the explosion of tankers, or due to the sinking of some ships, cleaning of their tanks, and oil leakage from them.

Sources of water pollution with oil

1- Some oil tankers empty the contents of their tanks of petroleum residues into the seas, and these oil materials are transported to the coasts, causing pollution to the coastal environment.

2- Oil tankers sank or collide with other ships.

3- The flow of petroleum oil during oil exploration operations in offshore areas.

4- Throwing the residues of the petroleum industries into the seas.

5- The leak that may occur from the explosion of oil wells in the sea or the occurrence of chemical corrosion in offshore oil pipelines.

Oil Pollution Control

The contaminated area is disposed of in the following ways:

1- Use of booms to fencing the oil slick to prevent the spread of the oil.

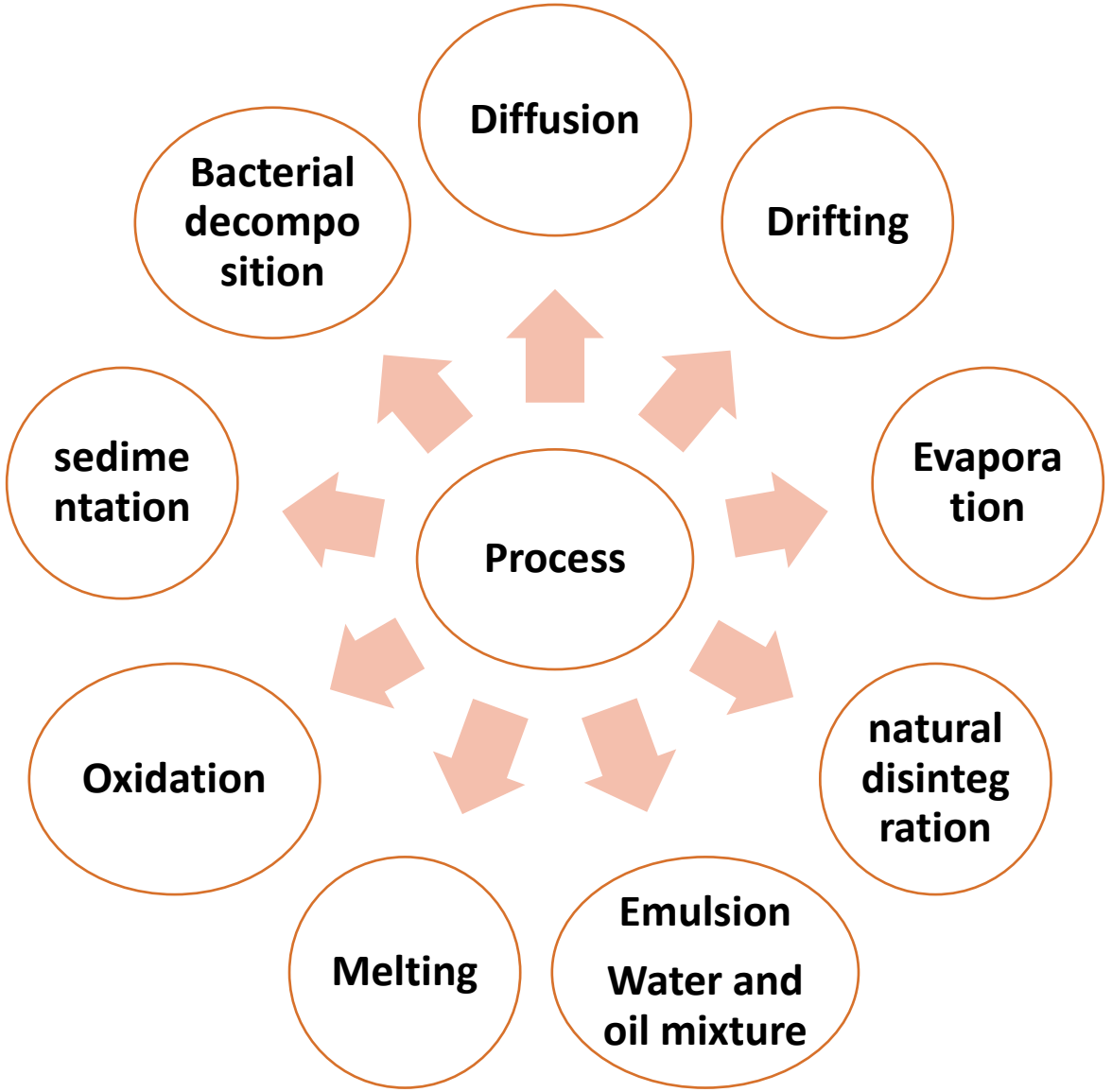
2- Using absorbent materials that partially impede the movement of the oil slick, such as glass wool.

3- Using devices that scrape the thick layer of oil floating on the surface of the water, and the skimmed oil is collected and withdrawn using pumps.

4- Oil pollution can be combated by bacteria, where the scientists found that some microscopic microorganisms can break oil materials. At the same time, they can convert oil slicks into very fine droplets in water.

5- The use of the suction method by special devices that absorb oil slicks, such as vacuum cleaners, and thus can separate oil from water.

The processes that the oil slick is exposed to while it is in the environment



The environmental and economical effects of oil pollution

Oil and its derivatives are considered of a high toxic risk due to the emission of gases when evaporating or decomposing spilled oil particles, as well as the crude oil containing other toxic gases such as hydrogen sulfide.

3. Its economic effects

The oil spill has significant economic effects, such as stopping production, its impact on fisheries, and the high costs of combating and cleaning up damaged beaches.

2. Effects on marine life

Oil affects and harms marine life, causing poisoning or death. The damage when the oil spills is instantaneous or long-term. The immediate damage to marine animals and plants on the surface of the water, such as birds or animals close to the surface, such as sea calves. As for the long-term damage, it is when the oil decomposes and its impact on the food chain of these marine organisms.

1. Impact on the industry

The spilled oil has an impact on factories and oil refineries, due to the danger of fires or explosions, and the biggest impact is on desalination plants, due to the possibility of drinking water mixing with toxic hydrocarbons, which causes shutting down the operation of these plants for extended periods.

Thermal Pollution

Corruption of the aquatic environment when hot water wastes are poured into rivers, lakes or seas. This hot water waste raises the temperature of the water body above its normal level, and thus can harm the animals and plants that live in the water. In some cases, fish may die due to the sudden and rapid rise in temperature resulting from the pouring of hot water waste, and water sources are exposed to a sudden change in their temperatures as a result of some industries, especially the electric power generation industries and oil industries, by throwing hot water into these The sources where these industries withdraw large quantities of water for cooling purposes and most of this water returns to the water sources after it is heated.

The effect of thermal pollution on water resources

2. Chemical effects

The rate of a chemical reaction depends on several factors, the most important of which is temperature. In general, the rate of the reaction doubles every ten degrees Celsius.

1. Natural effects

It affects the density of water, surface tension, solubility of gases in water, viscosity, and others.

3. Biological effects

Discharge of hot water affects the biological systems in the water source by:

1- Destruction of the protein structure of living organisms.

2- Exposure of organisms to high heat will lead to changes in the rates of reproduction, respiration and growth, and may lead to the death of these organisms. This effect is proportional to the amount of increase in temperature.

3- Increasing the temperature helps to increase parasites and harmful bacteria and increases the decomposition of organic matter, which reduces the percentage of oxygen.

4- Enzyme activity increases, causing organisms to consume more food in a shorter time than if the environment had not changed.

5-Changes in the environment can lead to the migration of living organisms from areas of heat to another more suitable environment, as well as to the migration of fish as well, and thus lead to a decrease in resources.


Thank You