

TD 01: Environmental Concepts

1 – Definitions:

1-1 – Environment:

It is the set of elements in the vicinity of a living being that interact with it directly or indirectly. It includes biotic elements (living beings) and abiotic elements (physical space and climatic conditions).

1-2 – Ecosystem:

It is the set of living beings (biocenosis), animals (zoocenosis), and plants (phytocenosis), occupying a physical, biological, geological, edaphic, and climatic environment (biotope), within a network of energy and matter exchanges, enabling the maintenance of life.

1-3 – Ecology:

It is the science of habitat, studying the living conditions of organisms and all types of interactions that exist between them and their environments.

2 – Indicators of Environmental Degradation:

2-1 – Pollution:

It is the presence of substances or heat in the air, water, or soil, likely to harm human health or the quality of ecosystems, leading to the destruction or gradual degradation of the environment. Pollution can take three different forms:

- **Soil pollution:**

This may involve salinization, often due to agricultural practices, or direct soil pollution of industrial or individual origin. The affected soil may become infertile and hostile to certain plant or animal species inhabiting it.

- **Water pollution:**

It can be of different origins:

- *Physical:* Thermal or radioactive. Thermal pollution is mainly caused by industries that use water as a cooling fluid, leading to significant warming of the affected watercourses.
- *Chemical:* Discharge of various chemical substances from industry, agriculture, or domestic effluents.
- *Organic:* Discharge of excess organic matter. This leads to eutrophication (abundant growth of algae at the expense of other species in aquatic environments).

- **Air pollution:**

Toxic chemical gases, mainly from combustion, such as sulfur dioxide (SO₂), nitrogen oxides (NO_x), carbon monoxide (CO), hydrogen sulfide (H₂S), and certain other greenhouse gases (from industry or engines).

2-2 – Effect of Pollution on the Environment:

2-2-1 – Greenhouse Effect:

- *Natural greenhouse effect:*

Our planet is surrounded by a gaseous envelope (atmosphere), naturally composed of about 77% nitrogen, 20% oxygen, and traces of water vapor (H₂O), methane (CH₄), nitrous oxide (N₂O), ozone (O₃), and carbon dioxide (CO₂). About 50% of the energy emitted by the sun is reflected by the ground back into the atmosphere. These gases trap solar radiation, maintaining an average temperature of +15 °C instead of –18 °C without the greenhouse effect (Fig. 01). Thus, the natural greenhouse effect is a beneficial phenomenon, responsible for the mildness of our climate, while also contributing to global warming.

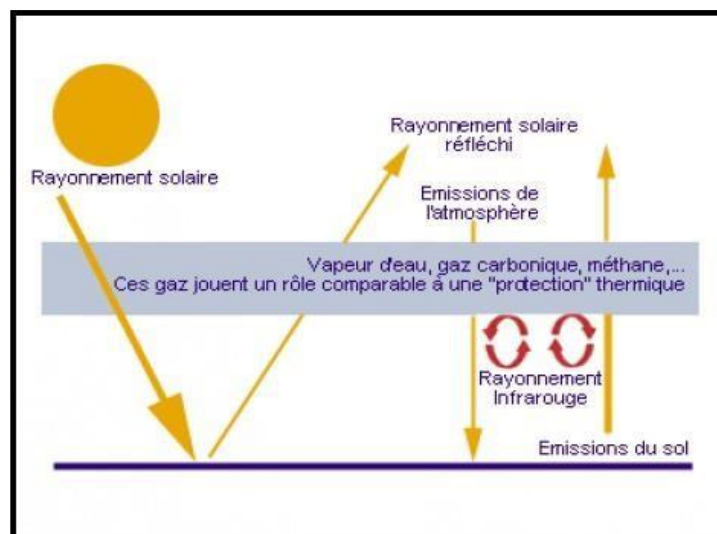


Figure 01. Additional Greenhouse Effect

- *Additional Greenhouse Effect:*

Since the Industrial Revolution (19th century), economic and demographic growth have increased exponentially, which has contributed to the rising combustion of fossil fuels (coal, oil, gas, etc.). The

accumulation of these greenhouse gases (over +85%) has caused the “*additional greenhouse effect*”, a phenomenon that continues to threaten the planet’s balance and endanger all existing life.

Between 1980 and 2010, Earth’s temperature increased by about 0.85 °C, and if global warming continues at this rate, it will reach between 1.8 and 4 °C by 2100. The temperature of the sea surface has also increased by about 0.40 °C. Forecasts indicate that the average sea level will rise between 20 and 60 cm in the coming years. Due to global warming, infrared rays are increasingly unable to escape into space. It is estimated that one out of every ten people lives in an area threatened by rising temperatures and sea levels. At this accelerated pace of atmospheric warming, the planet will experience shortages of natural resources (water, biodiversity, etc.), a decline in agricultural land productivity, and an increase in extreme events (heatwaves, cyclones, earthquakes, storms, and floods, etc.).

2-2-2 – Ozone Layer Depletion:

The ozone layer is a part of the atmosphere located about 500 km above the Earth (a portion of the stratosphere). Its role is to absorb biologically harmful solar rays (ultraviolet radiation) that are dangerous to living organisms. These solar rays are responsible for activating oxygen molecules (O_2) in the stratosphere, which then combine with free oxygen atoms (O) to form ozone (O_3). This ozone acts as a natural filter for the Earth. The increase in global population and industrial activity has raised the level of greenhouse pollutants in the atmosphere. Once these gases reach the ozone layer, they cause the dissociation of ozone molecules into two oxygen molecules (O_2) and a free oxygen atom (O). The destruction of the ozone layer allows harmful ultraviolet rays to reach Earth, posing a real threat to all forms of life (causing diseases and natural damage). The amount of oxygen protected by the ozone envelope also decreases as the layer is depleted.

TD 02: Physico-chemical parameters of environmental analyses

1- Exercise 01:

The following table presents the results of the physico-chemical analyses of water samples taken from three stations in the Mila region. Comment on the table.

Table 1: Average values of the physico-chemical parameters of the three stations

Parameters Sites	Site 1	Site 2	Site 3
Temperature (°C)	28.3	20.5	21.5
pH	7.2	7.8	7.5
Electrical Conductivity (µS/cm)	1292	1310	1232

2- Exercise 02:

Table 2 presents the results of the physico-chemical analyses of wastewater samples from five stations. Interpret the values in the table and rank the stations from the most polluted to the least polluted.

Table 2. Physico-chemical parameters of raw wastewater from several stations in Algeria:

Parameters Stations	S01	S02	S03	S04	S05
pH	7.1	7.9	8.2	7.5	7.8
Electrical Conductivity (µS/cm)	529	2140	3103	2435	2066
Biochemical Oxygen Demand (BOD₅) (mg/L)	1.2	3.0	5.0	7.2	8.0