Environmental chemistry : is the scientific study of the chemical and biochemical phenomena that occur in natural places . It can be defined as the study of the sources, reactions, transport, effects, and fates of chemical species in the air, soil, and water environments; and the effect of human activity and biological activity on these.

Applications :

These can include:
Heavy metal contamination of land by industry. These can then be transported into water bodies and be taken up by living organisms.
Nutrients leaching from agricultural land into water courses, which can lead to algal blooms and eutrophication.
Urban runoff of pollutants washing off impervious surfaces (roads, parking lots, and rooftops) during rain storms. Typical pollutants include gasoline, motor oil and other hydrocarbon compounds, metals, nutrients and sediment (soil).Organometallic compounds.

Atmospheric regions:

1-Troposphere:

The troposphere is the lowest layer of Earth's atmosphere. It extends from Earth's surface to an average height of about 12 km, although this altitude actually varies from about 9 km at the poles to 17 km at the equator, with some variation due to weather. The troposphere is bounded above by the tropopause , a boundary marked by stable temperatures.
Although variations do occur, the temperature usually declines with increasing altitude in the troposphere because the troposphere is mostly heated through energy transfer from the surface. Thus, the lowest part of the troposphere (i.e. Earth's surface) is typically the warmest section of the troposphere. The troposphere contains roughly 75-80% of the mass of Earth's atmosphere. Fifty percent of the total mass of the atmosphere is located in the lower 5.6 km of the troposphere. It is primarily composed of nitrogen (78%) and oxygen (21%) with only small concentrations of other trace gases . Nearly all atmospheric water vapor or moisture is found in the troposphere, so it is the layer where most of Earth's weather takes place.

2-Stratosphere:

The stratosphere is the second-lowest layer of Earth's atmosphere. It lies above the troposphere and is separated from it by the tropopause. This layer extends from the top of the troposphere at roughly 12 km above Earth's surface to the stratopause at an altitude of about 50 to 55 km . It has all the same gas as troposphere, but very little water vapor and there are small amount of ozone and monoatomic oxygen.
The atmospheric pressure at the top of the stratosphere is roughly 1/1000 the pressure at sea level. It contains the ozone layer, which is the part of Earth's atmosphere that contains relatively high concentrations of that gas. The stratosphere defines a layer in which

temperatures rise with increasing altitude. This rise in temperature is caused by the absorption of ultraviolet radiation (UV) radiation from the Sun by the ozone layer, which restricts turbulence and mixing. Although the temperature may be −60 °C at the tropopause, the top of the stratosphere is much warmer, and may be near 0 °C.
The stratosphere is almost completely free of clouds and other forms of weather.

3-Mesosphere:

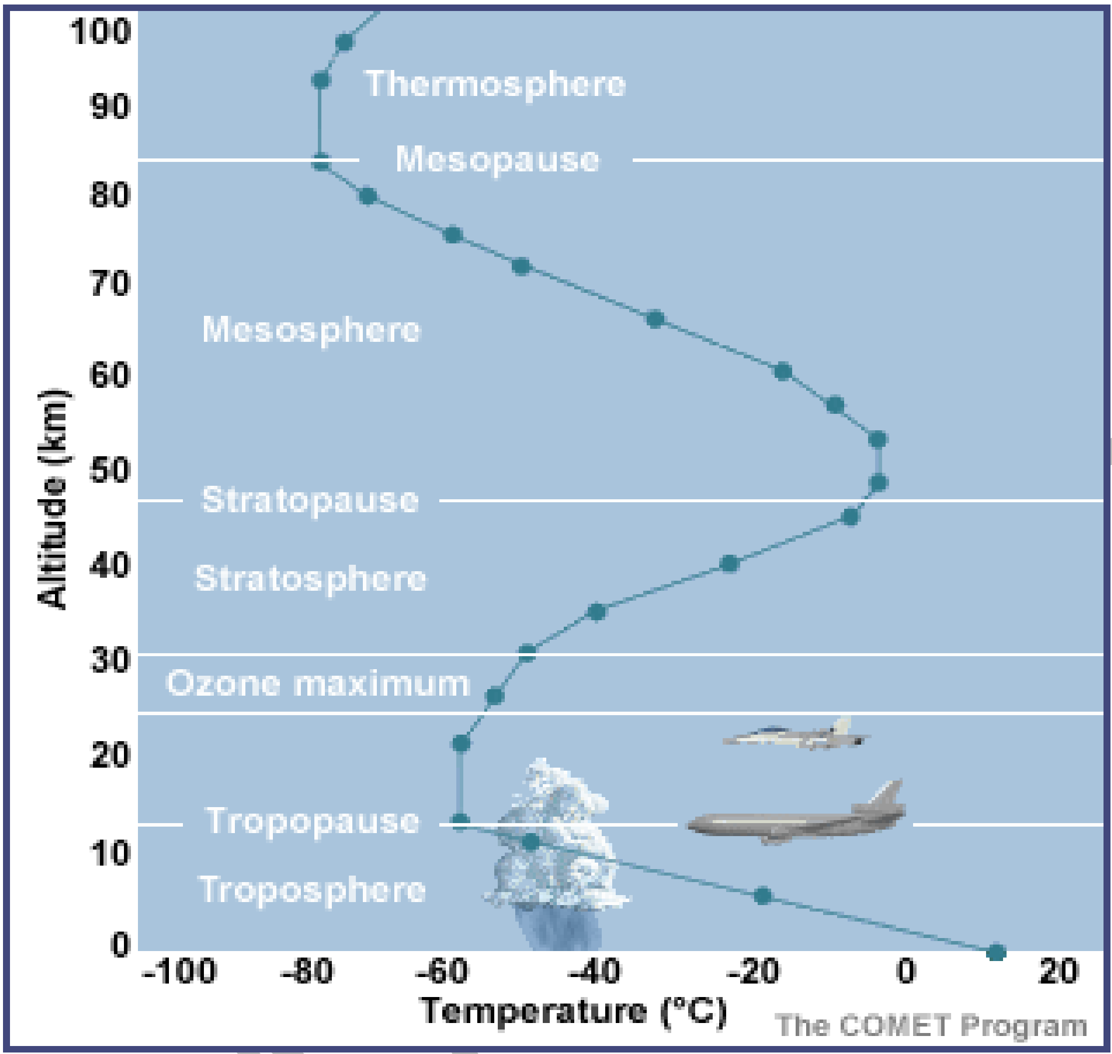
The mesosphere is the third highest layer of Earth's atmosphere, occupying the region above the stratosphere and below the thermosphere. It extends from the stratopause at an altitude of about 50 km to the mesopause at 80–85 km above sea level. This layer has a high concentration of iron and metal atoms.
Temperatures drop with increasing altitude to the mesopause that marks the top of this middle layer of the atmosphere. It is the coldest place on Earth and has an average temperature around −85 °C.
There are clouds which are the highest clouds in the atmosphere and may be visible to the naked eye if sunlight reflects off them about an hour or two after sunset or a similar length of time before sunrise.

4-Thermosphere:

The thermosphere is the second-highest layer of Earth's atmosphere. It extends from the mesopause (which separates it from the mesosphere) at an altitude of about 80 km up to the thermopause at an altitude range of 500–1000 km .The height of the thermopause varies considerably due to changes in solar activity. The lower part of the thermosphere, from 80 to 550 kilometres above Earth's surface, contains the ionosphere . 80% nitrogen and 20% oxygen.
This atmospheric layer undergoes a gradual increase in temperature with height. The temperature of this layer can rise as high as 1500 °C . This layer is completely cloudless and free of water vapor

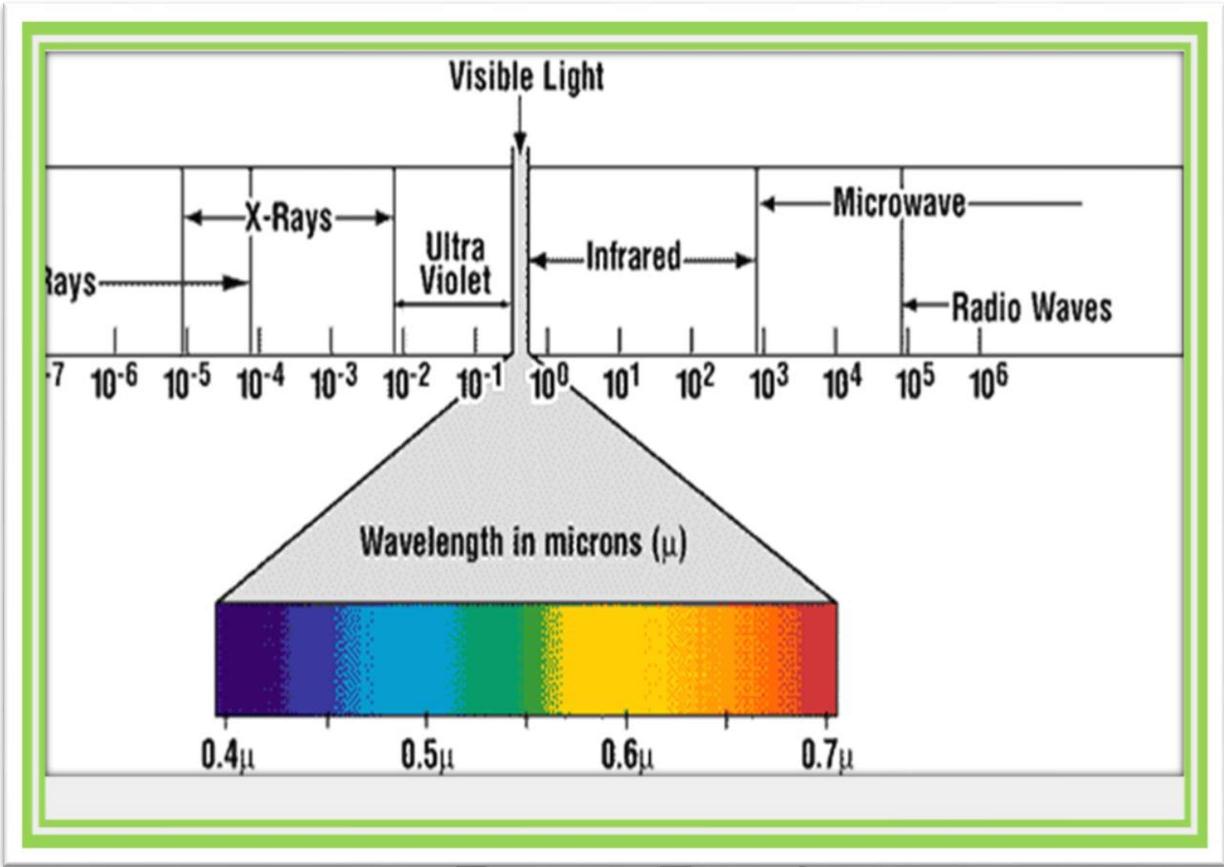
5-Exosphere:

The exosphere is the outermost layer of Earth's atmosphere (i.e. the upper limit of the atmosphere). It extends from the exopause, which is located at the top of the thermosphere at an altitude of about 700 km above sea level, to about 10,000 km .The exosphere merges with the emptiness of outer space, where there is no atmosphere.
This layer is mainly composed of extremely low densities of hydrogen, helium and several heavier molecules including nitrogen, oxygen and carbon dioxide closer to the exopause. The atoms and molecules are so far apart that they can travel hundreds of kilometers without colliding with one another.



Sunlight

As energy from the Sun passes through the atmosphere a number of things take place. A portion of the energy (26% globally) is reflected or scattered back to space by clouds and other atmospheric particles. About 19% of the energy available is absorbed by clouds, gases (like ozone), and particles in the atmosphere. Of the remaining 55% of the solar energy passing through the Earth's atmosphere, 4% is reflected from the surface back to space. On average, about 51% of the Sun's radiation reaches the surface. This energy is then used in a number of processes, including the heating of the ground surface; the melting of ice and snow and the evaporation of water; and plant photosynthesis.



Absorption (electromagnetic radiation)

Different molecules absorb different wavelengths of radiation. For example, O_2 and O_3 absorb almost all wavelengths shorter than 300 nanometers. Water (H_2O) absorbs many wavelengths above 700 nm. When a molecule absorbs a photon, it increases the energy of the molecule. This heats the atmosphere, but the atmosphere also cools by emitting radiation, as discussed below.

The combined absorption spectra of the gases in the atmosphere leave "windows" of low opacity, allowing the transmission of only certain bands of light. The optical window runs from around 300 nm (ultraviolet-C) up into the range humans can see, the visible spectrum (commonly called light), at roughly 400–700 nm and continues to the infrared to around 1100 nm. There are also infrared and radio windows that transmit some infrared and radio waves at longer wavelengths. For example, the radio window runs from about one centimeter to about eleven-meter waves.

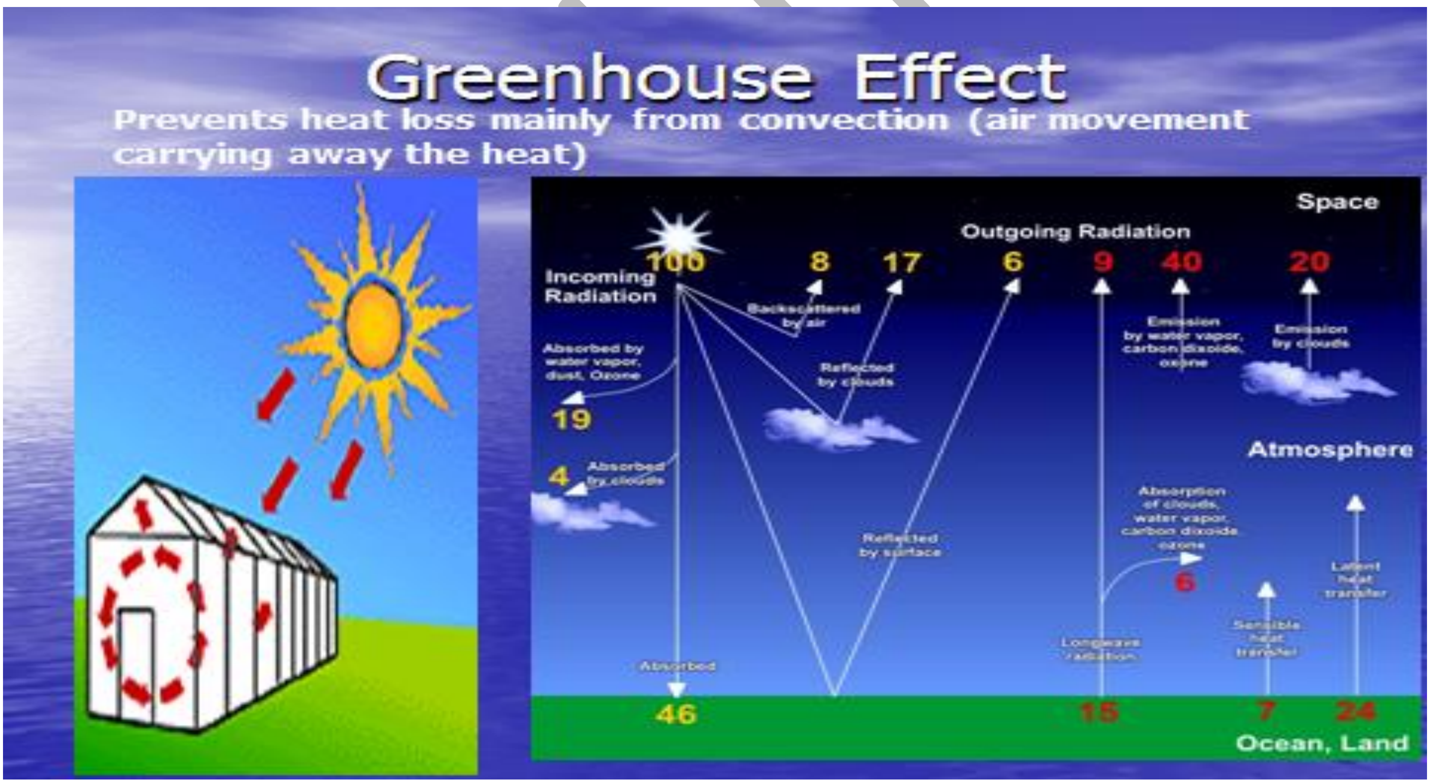
Emission (electromagnetic radiation)

Emission is the opposite of absorption, it is when an object emits radiation. Objects tend to emit amounts and wavelengths of radiation depending on their "black body" emission curves, therefore hotter objects tend to emit more radiation, with shorter wavelengths. Colder objects emit less radiation, with longer wavelengths.

For example, on clear nights Earth's surface cools down faster than on cloudy nights. This is because clouds (H2O) are strong absorbers and emitters of infrared radiation. This is also why it becomes colder at night at higher elevations.
The greenhouse effect is directly related to this absorption and emission effect. Some gases in the atmosphere absorb and emit infrared radiation, but do not interact with sunlight in the visible spectrum. Common examples of these are CO_2 and H_2O.

Greenhouse Effect and Global Warming

The greenhouse effect is the rise in temperature that the earth experiences because certain gases in the atmosphere (water vapor , carbon dioxide , nitrous oxide and methane) trap energy from the sun .Without these gases , heat would escape back into space and earth's average temperature would be about 60 ℉ colder . Because of how they warm our world , these gases are referred to as greenhouse gases.
Burning fossil fuels such as natural gas, coal, oil and gasoline raises the level of carbon dioxide in the atmosphere, and carbon dioxide is a major contributor to the greenhouse effect and global warming



Mechanism of greenhouse effect :
The Earth receives energy from the Sun in the form UV, visible, and near IR radiation, most of which passes through the atmosphere without being absorbed. Of the total amount of energy available at the top of the atmosphere , about 51% is absorbed at the Earth's surface. Because it is warm, the surface radiates far IR thermal radiation that consists of wavelengths

that are predominantly much longer than the wavelengths that were absorbed (the overlap between the incident solar spectrum and the terrestrial thermal spectrum is small enough to be neglected for most purposes). Most of this thermal radiation is absorbed by the atmosphere and re-radiated both upwards and downwards; that radiated downwards is absorbed by the Earth's surface. This trapping of long-wavelength thermal radiation leads to a higher equilibrium temperature than if the atmosphere were absent.

Atmospheric Composition

Chemical Species	Concentration	Source
N_2	78.08%	volcanic, biogenic
O_2	20.95%	biogenic
H_2O (gaseous)	up to 4% (avg ~2.5%)	volcanic, evaporation
Ar	0.93%	radiogenic
CO_2	0.037% (370 ppm$_v$)	volcanic, biogenic, anthropogenic
Ne	18 ppm$_v$	volcanic (possibly)
He	5.2 ppm$_v$	radiogenic
Kr	1 ppm$_v$	radiogenic
CO	50 – 200 ppm$_v$	biogenic, anthropogenic, photochemical
CH_4	1.7 ppm$_v$	biogenic, anthropogenic
NMHC	5 – 20 ppb$_v$	biogenic, anthropogenic, photochemical
CH_2O	0.1 ppb$_v$	photochemical
N_2O	310 ppb$_v$	biogenic, anthropogenic
NH_3	0 – 0.5 ppb$_v$	biogenic, anthropogenic
NO_x	0 – 0.5 ppb$_v$	biogenic, anthropogenic, lightning
OCS	0.5 ppb$_v$	volcanic, biogenic, anthropogenic
H_2S	0 – 0.5 ppb$_v$	biogenic, anthropogenic
SO_2	0.01 – 1 ppb$_v$	volcanic, anthropogenic, photochemical
DMS	0.01 – 0.1 ppb$_v$	biogenic