ASSIGNMENT No. 01

Environmental Pollution (1422) BA (General)

Autumn, 2018

Q.No.1 Explain the terms environment, pollution and history of pollution. (20)

EPA's Air, Climate, and Energy Research is at the forefront of air pollution research to protect public health and the environment. The research is providing the scientific foundation for the U.S. Environmental Protection Agency, states and communities to make decisions to effectively reduce and control air pollution.

Then

In October 1948, Donora, Pa., was enveloped in a lethal haze.

Over five days, nearly half of the town's 14,000 residents experienced severe respiratory or cardiovascular problems. It was difficult to breathe. The death toll rose to nearly 40. Disturbing photos show Donora's streets hidden under a thick blanket of gray smog. A warm air pocket had passed high above the town, trapping cooler air below and sealing in pollutants. Donora was no stranger to pollution. Steel and zinc smelters had long plagued the town with dirty air. But the air pocket left pollutants with no escape route. They sat stewing in the streets, where residents breathed them in lethal doses. The situation in Donora was extreme, but it reflected a trend. Air pollution had become a harsh consequence of industrial growth across the country and world. Crises like Donora's were widely publicized; people took notice and began to act. Scientists started investigating the link between air pollution and health. States began passing legislation to reduce air pollution. And in 1970, a milestone year, Congress passed the Clean Air Act Amendments which led to the establishment of the nation's air quality standards.

Now

Today, policymakers and air quality managers rely on cutting-edge science to establish regulations and make management decisions to reduce and control air pollution with cost-effective approaches. EPA's Air, Climate, and Energy Research conducts a vast amount of this research, producing findings and developing technology vital to our understanding of air pollution. For the most common pollutants, the research is compiled and synthesized every five years by EPA scientists to assess the adequacy of air regulations.

EPA seeks to identify specific chemicals as well as specific sources (like cars, trucks and power plants) that can impact air quality. A major goal is to pinpoint the sources most responsible for health risks.
For example, EPA studies have shown that tiny particles released when gas, oil and other fossil fuels are burned harm the respiratory and cardiovascular systems. We now know that these particles are especially harmful to the most vulnerable populations: the young, older adults and those with pre-existing health conditions. The research program provides an innovative and interdisciplinary approach to the air pollution problem. Renowned EPA scientists, engineers and physicians work together and partner with scientific experts across the United States and worldwide to address the many challenges of air quality management.

Future Directions

Major strides have been made to improve air quality, but many complex scientific questions remain, calling for innovative and novel research. It has become increasingly clear that multiple pollutants play a role in determining risks to people and the environment. EPA is moving forward with a "multipollutant" approach to air pollution research. It is crucial to understand the collective impacts of multiple air pollutants, how they interact in the atmosphere and whether the interactions modify health effects. EPA's Air, Climate, and Energy Research has already spearheaded interdisciplinary efforts to study combinations of multiple pollutants more extensively.

Research has linked regulated air pollutants such as ozone and particulate matter (PM) to lung and heart disease and other health problems. More investigation is needed to further understand the role poor air quality plays on health and disease and support development of more sustainable and integrated air quality management strategies. The findings are supporting the review of the nation's National Ambient Air Quality Standards (NAAQS).

Climate change and air quality interact

EPA is also pursuing an understanding of how climate change and air quality interact and the consequences for public health and the environment. EPA scientists have already provided evidence that future temperature increases will increase air pollution levels in some regions of the country. What's more, urban areas already suffering from pollution problems may incur the greatest burden of these changes. Advancements in air sensor monitoring technology is providing new lower-cost devices to help air quality managers, communities and citizens with understanding air quality. EPA researchers are at the forefront of the development and evaluation of air sensor monitors. EPA will continue investigations of how climate change will impact the air we breathe, with a focus on protecting current and future generations from air pollution health risks.

QNo.2 Define and explain terrestrial and aquatic pollution in your own words. (20)

Creation of life form is because of environment. Sun/moon, sea/ earth, hot/ cold and forests/ desert etc; they together made an environment that is fit for our existence. There are two different environments one is positive and the other one is negative, life forms in both namely, pests, insects and others are cold blooded have different conditions which suits them to survive that may not be suitable to us, both have own identities. Most important factor is that negative positive factors have to join together to form an environment for example mother/ father for birth of a child, negative/ positive of energy for electricity. In the system of environment, both have integral role to play. Where negative dominates outlines its systems and where positive dominates forms its own.

Environment motivates to react:

We are miserable when are in desert and delighted when we are in lush garden. In a hospital we are in different mood and in disco different. Environment motivates us to change our mood and reaction is in accordance.

We also generate/alter environment in our surroundings by our practice. Depends on the behavior of the individuals. Positive thinkers have positive feelings and negative thinkers it is negative, creates environment accordingly. This process turns to evolutionary system when a group of people have same thinking that initiates others to follow. Human lust and excessive usage of natural wood causing deforestation, pollution heating temperature is negative environment for us.

Making decisions and taking action:

Environmental sustainability involves making decisions and taking action that are in the interests of protecting the natural world, with particular emphasis on preserving the capability of the environment to support human life. It is an important topic at the present time, as people are realizing the full impact that businesses and individuals can have on the environment. What is Environmental Sustainability?

Environmental sustainability is about making responsible decisions that will reduce your business' negative impact on the environment. It is not simply about reducing the amount of waste you produce or using less energy, but is concerned with developing processes that will lead to businesses becoming completely sustainable in the future.

Receives plenty of attention:

Currently, environmental sustainability is a topical issue that receives plenty of attention from the media and from different governmental departments. This is a result of the amount of research going into assessing the impact that human activity can have on the environment. Although the long term implications of this serious issue are not yet fully understood, it is generally agreed that the risk is high enough to merit an immediate response. Businesses are expected to lead in the area of environmental sustainability as they are considered to be the biggest contributors and are also in a position where they can make a significant difference.For much of the past, most businesses have acted with little regard or concern for the negative impact they have on the environment. Many large and small organizations are guilty of significantly polluting the environment and engaging in practices that are simply not sustainable. However, there are now an increasing number of businesses that are committed to reducing their damaging impact and even working towards having a positive influence on environmental sustainability.

Sustainability forces businesses:
Environmental sustainability forces businesses to look beyond making short term gains and look at the long term impact they are having on the natural world. You need to consider not only the immediate impact your actions have on the environment, but the long term implications as well. For example, when manufacturing a product, you need to look at the environmental impact of the products entire lifecycle, from development to disposal before finalizing your designs.

European environmental history today:

During the last 30 years environmental history grew from an interest of some historians and natural scientists into a full-fledged academic discipline. In the United States environmental history gained a firm institutionalized base which is reflected in the fact that the annual meetings of the American Society for Environmental History, established in 1975, attracts over 500 participants. Environmental historical research in Europe is still fragmented but there are very promising and successful initiatives, both on the national and pan-European level. In 1986, the Dutch foundation for the history of environment and hygiene Net Work was founded. One of the most important goals of this foundation was to improve the communication between Dutch researchers with an interest in environmental history. The foundation publishes four newsletters per year.

Since 1995, the White Horse Press in Cambridge (UK) is publishing a journal with the title Environment and History. As an interdisciplinary journal, Environment and History aims to bring scholars in the humanities and biological sciences closer together in constructing long and well-founded perspectives on present day environmental problems. The same can be said for the Tijdschrift voor Ecologische Geschiedenis (Journal for Environmental History), a combined Flemish- Dutch initiative published by the Academia Press in Gent, Belgium. This journal is mainly dealing with topics in the Netherlands and Belgium but it also has an interest in European environmental history. Each issue contains abstracts in English, French and German. In 1999 the Journal was changed into a yearbook for environmental eistory and since then every year a volume has been published. The aims and content of this annual book is similar to the former journal.

The historian and environmental history:

Environmental history is an interdisciplinary subject. That means that historians, scientists and other scholars must look over the boundaries of their own subject. The historian must be aware that he or she sometimes needs to apply some principles from the natural sciences, such as ecology, biology and forestry, to understand what happened in the past. However, this does not mean that the historian must become a scientist. He is and remains an historian with the task to master and understand the past as a key to a better understanding of the present. But to do so he or she must look over the boundaries of history and even the humanities and acquaint themselves with the nomenclature and principles of other disciplines, especially the natural sciences. This does not mean that they have to become experts in these fields, but to use it as a tool to get a better understanding of historical problems.

Environmental historians:

Donald Worster has recognized three clusters of issues to be addressed by environmental historians. The first cluster deals with the human intellectual realm consisting of perceptions, ethics, laws, myth and the other mental constructions related to the natural world. Ideas about the world around us influence the way we deal with the natural environment. Here we enter the second level of issues to be studied: the level of the socio-economic realm. Ideas have an impact on politics, policies and the economy through which ideas materialize in the natural world.

Actions to influence the material world:

But the world is not static, so it reacts on our actions to influence the material world. With the impact of human actions the natural world we enter the third level of environmental history. This level deals with understanding nature itself, the natural realm. In the case of woodland history it is the way forest ecosystems have been working in the past and how they were changed by human actions. The impact of human actions on the natural world is causing a feedback that changes our ideas, policies, economy etc. In this way the natural world defines the limits of what we can do, and what not. Within this framework we try to change reactions we do not like and continue practices which, in our view, are successful. This model of the interaction between man and the environment depicts the concept of the separation between humans and nature. Although this division between the human and the natural realms is an artificial one, it can be a useful tool for the environmental historian in identifying important questions, the sources that might be able to answer the questions and the methods used to study these sources.

Q.No.3 Discuss the sources of air pollution with special reference to indoor air pollution. (20)

Man-made Environment

With the development of science and technology, human beings have begun to alter the environment to suit their requirements. This has led to the evolution of a man-made environment. Hence, the environment— which earlier comprised just air, land, and water—now also includes crop fields, urban areas, industrial space, vehicles, power plants, telecommunications, and much more.

The basic needs of human beings are shelter, followed by potable water and sanitation. The houses of people in the city are made of brick and cement and not of mud with a thatched roof. The resources for urban housing are transported from rural areas in cars, buses, trucks and trains, which consume a large amount of energy and pollute the atmosphere. The ever-increasing demand for comfort has resulted in the migration of people from villages to urban areas. Urban areas, on the other hand, are unable to meet the demands of basic civic amenities. As a result, they are becoming hovels of dirt, disease and crime. This has resulted in the paradox of concrete skyscrapers coexisting with slums and the atmosphere being polluted with exhaust from traffic, factories and domestic smoke.

Hydrosphere:

All types of water resources, namely the oceans, seas, rivers, lakes, ponds, polar ice caps, streams, glaciers, ground water, and water vapour are collectively known as the hydrosphere. Water being the elixir of life, all ancient civilizations were linked to major sources of water, be it the Egyptian Civilization along the River Nile, the Indus Valley Civilization along the River Indus, or the Mesopotamian Civilization between the Tigris and Euphrates rivers.

The hydrosphere is an important part of the earth's surface. About 70 per cent of the earth's surface is covered with water. The northern hemisphere is dominated by land surface, while the southern hemisphere is almost entirely occupied by water bodies (oceans). Water is the most essential component of life for all living organisms. The hydrosphere is of immense importance to mankind. It maintains the availability of fresh water to the biosphere through the hydrological cycle. A major component of the hydrological cycle is the ocean. The oceans are great reservoirs of water and they also regulate carbon dioxide. The oceans can absorb more carbon dioxide than the atmosphere. Oceans are also the storehouses of vast resources, such as, water, salt, minerals, and food. The oceans are the largest sinks (pollutant receptor) of the planet. Thus, the role of the hydrosphere is critical to the sustenance of life on the earth. This is underlined by the fact that life on the earth originated under marine conditions.

Lithosphere:

The lithosphere is the outermost mantle of the rocks constituting the earth's crust. Rocks are subjected to continuous physical, chemical and biological (attack by lichens) weathering. Plants grow and decay on the soil covering the rocks. Soil is the major component of the lithosphere. The organic matter in soil is decomposed by micro-organisms, thus forming biomass. This biomass is mixed with the soil fauna. The major components of soil are air, water, minerals, and inorganic matter obtained from weathering of the parent rock. Organic matter of soil comprises plant biomass that is in various stages of decay. It also includes a high population of bacteria, fungi and animals such as nematodes, micro arthropods, termites and earthworms. Soil plays a vital role in supplying nutrients to the plant kingdom. The nutrient supply power of soil is a measure of its fertility, while the productivity of the soil is a function of crop and animal biomass per unit area. Thus, the yield of crop depends solely on soil and crop management strategies.

The lithosphere has a thickness ranging from 64 to 96 km. The uppermost part of the lithosphere (the earth's crust) is rich in silica (Si) and aluminium (Al) and is therefore, known as the SiAl layer. The continents belong to the SiAl layer and are made up of granite rocks.

The zone next to the SiAl is rich in silica (Si) and magnesium (Mg). This layer is formed of basalt rocks and constitutes the ocean floors. The basalt rocks are heavier than the rocks formed by SiAl layer. Below the SiMg layer, the density of the layers increases with depth. Such differences in density cause the constituting layers to float, one over the other. The continents are basically large segments or 'plates' of the earth's crust floating on top of this heavier layer. These floating plates are responsible for the tectonic movement of the earth's surface during an earthquake.

Lithosphere and thickness

Below the lithosphere lies the mantle, which has a thickness of about 2400 km. The upper part of the mantle is known as the Asthenosphere, while the lower mantle is called the Mesosphere. The interior-most part of the earth is called the Core, which consists of minerals such as iron, nickel, cobalt mixed with sulphur, and silica. The thickness of the core extends to about 3500 km. The Core consists of the outer core and the inner core. The inner core appears to be solid, while the outer core is molten and metallic. The temperature of the core ranges between 5000 and 5500°C.

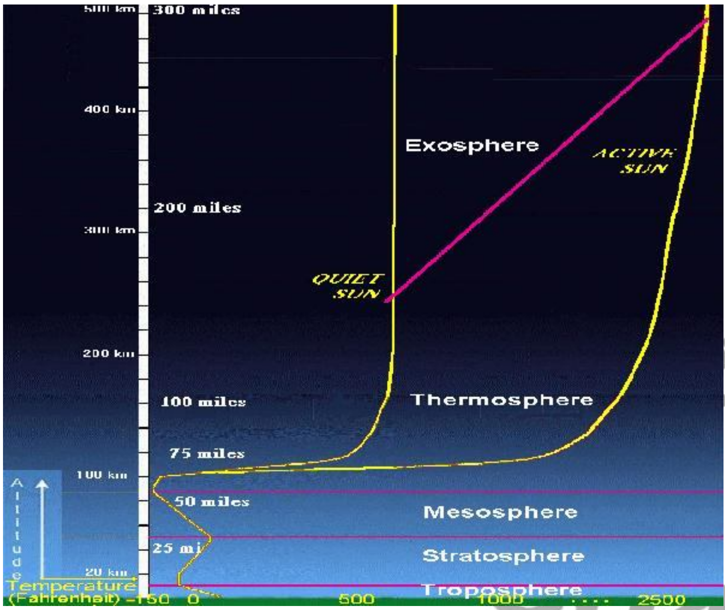
The direct interaction between the atmosphere, hydrosphere and lithosphere for millions of years has made the earth suitable for life and has formed the biosphere.

Biosphere: Life on earth occupies a 'thin skin' extending more than a few kilometres below and above its surface. This is commonly known as the biosphere. Both the biosphere and environment influence each other a lot. The oxygen and carbon dioxide levels of the atmosphere depend entirely on the plant kingdom. All the different biogeochemical cycles are essential for the continuous circulation of constituents necessary for supporting life. This is possible due to the interaction of the biosphere and the environment

It is in the biosphere that radiant energy is converted to chemical form (carbohydrates) through the process of photosynthesis. Only then does energy transfer take place from chemical to mechanical, and heat forms during cellular metabolism.

Q.No.4 Explain the structure of atmosphere. Support your answer with suitable diagram. (20)

The changes in the atmosphere with height are results of specific physical conditions which exist on the earth and in its atmosphere. The vertical changes in temperature are important in constraining weather events to the lowest 10-12 km of the atmosphere. The ozone layer, located near 25 km above the earth's surface, causes the temperature to rapidly change in the middle atmosphere.



The gaseous area surrounding the planet is divided into several concentric strata or layers. About 99% of the total atmospheric mass is concentrated in the first 20 miles (32 km) above Earth's surface. Historical outline on the discovery of atmospheric structure.

THERMAL STRUCTURE

Atmospheric layers are characterized by variations in temperature resulting primarily from the absorption of solar radiation; visible light at the surface, near ultraviolet radiation in the middle atmosphere, and far ultraviolet radiation in the upper atmosphere.

Troposphere

The troposphere is the atmospheric layer closest to the planet and contains the largest percentage (around 80%) of the mass of the total atmosphere. Temperature and water vapor content in the troposphere decrease rapidly with altitude. Water vapor plays a major role in regulating air temperature because it absorbs solar energy and thermal radiation from the planet's surface. The troposphere contains 99 % of the water vapor in the atmosphere. Water vapor concentrations vary with latitude. They are greatest above the tropics, where they may be as high as 3 %, and decrease toward the polar regions.

All weather phenomena occur within the troposphere, although turbulence may extend into the lower portion of the stratosphere. Troposphere means "region of mixing" and is so named because of vigorous convective air currents within the layer.

The upper boundary of the layer, known as the tropopause, ranges in height from 5 miles (8 km) near the poles up to 11 miles (18 km) above the equator. Its height also varies with the seasons; highest in the summer and lowest in the winter.

Stratosphere

The stratosphere is the second major strata of air in the atmosphere. It extends above the tropopause to an altitude of about 30 miles (50 km) above the planet's surface. The air temperature in the stratosphere remains relatively constant up to an altitude of 15 miles (25 km). Then it increases gradually to up to the stratopause. Because the air temperature in the stratosphere increases with altitude, it does not cause convection and has a stabilizing effect on atmospheric conditions in the region. Ozone plays the major role in regulating the thermal regime of the stratosphere, as water vapor content within the layer is very low. Temperature increases with ozone concentration. Solar energy is converted to kinetic energy when ozone molecules absorb ultraviolet radiation, resulting in heating of the stratosphere.

The ozone layer is centered at an altitude between 10-15 miles (15-25 km). Approximately 90 % of the ozone in the atmosphere resides in the stratosphere. Ozone concentration in the this region is about 10 parts per million by volume (ppmv) as compared to approximately 0.04 ppmv in the troposphere. Ozone absorbs the bulk of solar ultraviolet radiation in wavelengths from 290 nm - 320 nm (UV-B radiation). These wavelengths are harmful to life because they can be absorbed by the nucleic acid in cells. Increased penetration of ultraviolet radiation to the planet's surface would damage plant life and have harmful environmental consequences. Appreciably large amounts of solar ultraviolet radiation would result in a host of biological effects, such as a dramatic increase in cancers.

Mesosphere

The mesosphere a layer extending from approximately 30 to 50 miles (50 to 85 km) above the surface, is characterized by decreasing temperatures. The coldest temperatures in Earth's atmosphere occur at the top of this layer, the mesopause, especially in the summer near the pole. The mesosphere has sometimes jocularly been referred to as the "ignorosphere" because it had been probably the least studied of the atmospheric layers. The stratosphere and mesosphere together are sometimes referred to as the middle atmosphere.

Thermosphere

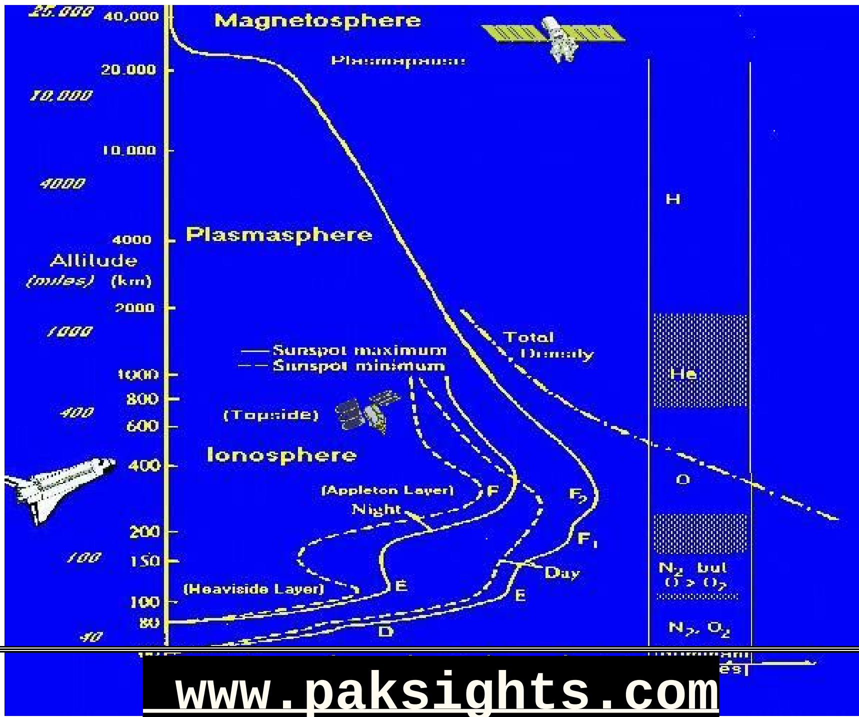
The thermosphere is located above the mesosphere. The temperature in the thermosphere generally increases with altitude reaching 600 to 3000 F (600-2000 K) depending on solar activity. This increase in temperature is due to the absorption of intense solar radiation by the limited amount of remaining molecular oxygen. At this extreme altitude gas molecules are widely separated. Above 60 miles (100 km) from Earth's surface the chemical composition of air becomes strongly dependent on altitude and the atmosphere becomes enriched with lighter gases (atomic oxygen, helium and hydrogen). Also at 60 miles (100 km) altitude, Earth's atmosphere becomes too thin to support aircraft and vehicles need to travel at orbital velocities to stay aloft. This demarcation between aeronautics and astronautics is known as the Karman Line. Above about 100 miles (160 km) altitude the major atmospheric component becomes atomic oxygen. At very high altitudes, the residual gases begin to stratify according to molecular mass, because of gravitational separation.

Exosphere

The exosphere is the most distant atmospheric region from Earth's surface. In the exosphere, an upward travelling molecule can escape to space (if it is moving fast enough) or be pulled back to Earth by gravity (if it isn't) with little probability of colliding with another molecule. The altitude of its lower boundary, known as thethermopause or exobase, ranges from about 150 to 300 miles (250-500 km) depending on solar activity. The upper boundary can be defined theoretically by the altitude (about 120,000 miles, half the distance to the Moon) at which the influence of solar radiation pressure on atomic hydrogen velocities exceeds that of the Earth's gravitational pull. The exosphere observable from space as the geocorona is seen to extend to at least 60,000 miles from the surface of the Earth. The exosphere is a transitional zone between Earth's atmosphere and interplanetary space.

MAGNETO-STRUCTURE ELECTRONIC

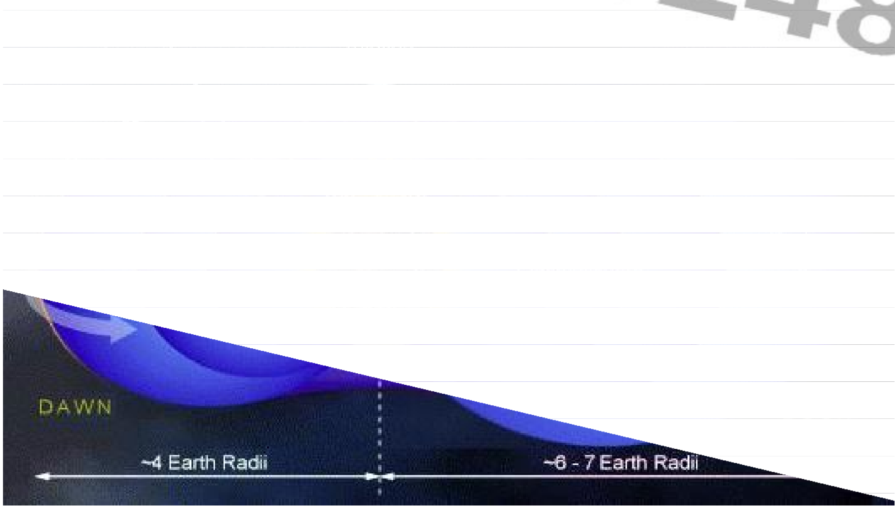
The upper atmosphere is also divided into regions based on the behavior and number of free electrons and other charged particles.



Ionosphere

The ionosphere is defined by atmospheric effects on radiowave propagation as a result of the presence and variation in concentration of free electrons in the atmosphere.

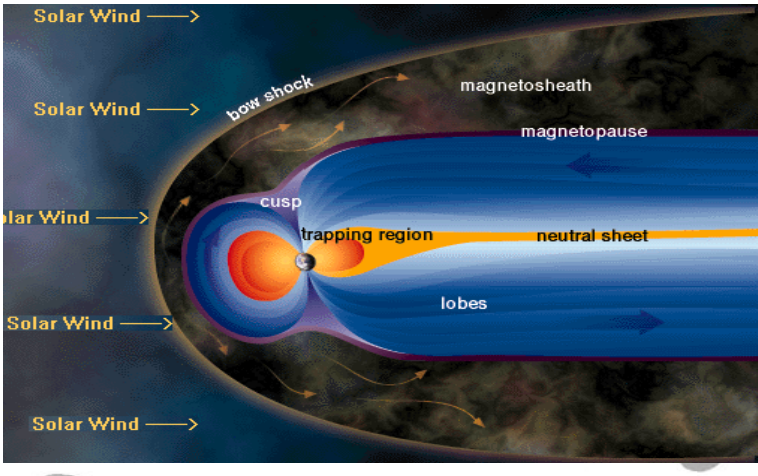
D-region is about 35 to 55 miles (60 - 90 km) in altitude but disappears at night.
E-region is about 55 to 90 miles (90 - 140 km) in altitude.
F-region is above 90 miles (140 km) in atitude. During the day it has two regions known as the F_1-region from about 90 to 115 miles (140 to 180 km) altitude and the F_2-region in which the concentration of electrons peaks in the altitude range of 150 to 300 miles (around 250 to 500 km). Most recent map of the Height of Maximum (hmF2). The ionosphere above the peak electron concentration is usually referred to as the Topside Ionosphere.



Plasma sphere

The plasmasphere is not really spherical but a doughnut-shaped region (a torus) with the hole aligned with Earth's magnetic axis. [In this case the use of the suffix -sphere is more in the figurative sense of a "sphere of influence".] The Earth's plasmasphere is made of just that, a plasma, the fourth state of matter. (Test your skills on sorting the states of matter with the Matter Sorter.) This plasma is composed mostly of hydrogen ions (protons) and electrons. It has a very sharp edge called theplasmapause. The outer edge of this doughnut over the equator is usually some 4 to 6 Earth radii from the center of the Earth or 12,000-20,000 miles (19,000-32,000 km) above the surface. The plasmasphere is essentially an extension of the ionosphere. Inside of the plasmapause, geomagnetic field lines rotate with the Earth. The inner edge of the plasmasphere is taken as the altitude at which protons replace oxygen as the dominant species in the ionospheric plasma which usually occurs at about 600 miles (1000 km) altitude. The plasmasphere can also be considered to be a structure within the magnetosphere.

Magnetosphere



Outside the plasmapause, magnetic field lines are unable to coronate because they are influenced strongly by electric fields of solar wind origin. The magnetosphere is a cavity (also not spherical) in which the Earth's magnetic field is constrained by the solar wind and interplanetary magnetic field (IMF). The outer boundary of the magnetosphere is called the magnetopause. The magnetosphere is shaped like an elongated teardrop (like a Christmas Tree ornament) with the tail pointing away from the Sun. The magnetopause is typically located at about 10 Earth radii or some 35,000 miles (about 56,000 km) above the Earth's surface on the day side and stretches into a long tail, the magneto tail, a few million miles long (about 1000 Earth radii), well past the orbit of the Moon (at around 60 Earth radii), on the night side of the Earth. However, the Moon itself is usually not within the magnetosphere except for a couple of days around the Full Moon.

Beyond the magnetopause are the magneto sheath and bow shock which are regions in the solar wind disturbed by the presence of Earth and its magnetic field.

Q.No.5 Write short notes on the followings: (5 each) (20)

a. Enlist major air pollutants

Major air pollutions are:

Carbon Monoxide (CO)

Pollutants facts Fuel combustion from vehicles and engines. Pollutants factsReduces the amount of oxygen reaching the body's organs and tissues; aggravates heart disease, resulting in chest pain and other symptoms.

Ground-level Ozone (O3)

Pollutants fact sSecondary pollutant formed by chemical reaction of volatile organic compounds (VOCs) and NOx in the presence of sunlight. Pollutants factsDecreases lung function and causes respiratory symptoms, such as coughing and shortness of breath, and also makes asthma and other lung diseases get worse. More on Ground Level Ozone Here

Lead (Pb)

Pollutants factsSmelters (metal refineries) and other metal industries; combustion of leaded gasoline in piston engine aircraft; waste incinerators (waste burners), and battery manufacturing.

Pollutants fact sDamages the developing nervous system, resulting in IQ loss and impacts on learning, memory, and behavior in children. Cardiovascular and renal effects in adults and early effects related to anaemia.

Nitrogen Dioxide (NO2)

Pollutants factsFuel combustion (electric utilities, big industrial boilers, vehicles) and wood burning. Pollutants factsWorsens lung diseases leading to respiratory symptoms, increased susceptibility to respiratory infection.

Particulate Matter (PM)

Pollutants factsThis is formed through chemical reactions, fuel combustion (e.g., burning coal, wood, diesel), industrial processes, farming (plowing, field burning), and unpaved roads or during road constructions. Pollutants factsShort-term exposures can worsen heart or lung diseases and cause respiratory problems. Long-term exposures can cause heart or lung disease and sometimes premature deaths.

Sulfur Dioxide (SO2)

Pollutants facts SO2 comes from fuel combustion (especially high-sulfur coal); electric utilities and industrial processes as well as natural occurrences like volcanoes. Pollutants factsAggravates asthma and makes breathing difficult. It also contributes to particle formation with associated health effects.

b. Effects of acid deposition

Acid rain describes any form of precipitation with high levels of nitric and sulfuric acids. It can also occur in the form of snow, fog, and tiny bits of dry material that settle to Earth. Rotting vegetation and erupting volcanoes release some chemicals that can cause acid rain, but most acid rain falls because of human activities. The biggest culprit is the burning of fossil fuels by coal-burning power plants, factories, and automobiles. When humans burn fossil fuels, sulfur dioxide (SO2) and nitrogen oxides (NOx) are released into the atmosphere. These chemical gases react with water, oxygen, and other substances to form mild solutions of sulfuric and nitric acid. Winds may spread these acidic solutions across the atmosphere and over hundreds of miles. When acid rain reaches Earth, it flows across the surface in runoff water, enters water systems, and sinks into the soil.

Effects

Acid rain has many ecological effects, but none is greater than its impact on lakes, streams, wetlands, and other aquatic environments. Acid rain makes waters acidic, and causes them to absorb the aluminum that makes its way from soil into lakes and streams. This combination makes waters toxic to crayfish, clams, fish, and other aquatic animals.

c. Earth as a Green-house

Gases that trap heat in the atmosphere are called greenhouse gases. This section provides information on emissions and removals of the main greenhouse gases to and from the atmosphere. For more information on the science of climate change and other climate forcers, such as black carbon, please visit Climate Change Science.

Carbon dioxide (CO_2): Carbon dioxide enters the atmosphere through burning fossil fuels (coal, natural gas, and oil), solid waste, trees and wood products, and also as a result of certain chemical reactions (e.g., manufacture of cement). Carbon dioxide is removed from the atmosphere (or "sequestered") when it is absorbed by plants as part of the biological carbon cycle.

Methane (CH_4): Methane is emitted during the production and transport of coal, natural gas, and oil. Methane emissions also result from livestock and other agricultural practices and by the decay of organic waste in municipal solid waste landfills.

Nitrous oxide (N_2O): Nitrous oxide is emitted during agricultural and industrial activities, as well as during combustion of fossil fuels and solid waste.

Fluorinated gases: Hydro fluorocarbons, per fluorocarbons, sulfur hexafluoride, and nitrogen trifluoride are synthetic, powerful greenhouse gases that are emitted from a variety of industrial processes. Fluorinated gases are sometimes used as substitutes for stratospheric ozone-depleting substances (e.g., chlorofluorocarbons, hydro chlorofluorocarbons, and halons). These gases are typically emitted in smaller quantities, but because they are potent greenhouse gases, they are sometimes referred to as High Global Warming Potential gases ("High GWP gases").

d. Coping with Global Warming

The world is on track to reach dangerous levels of global warming much sooner than expected, according to new Australian research that highlights the alarming implications of rising energy demand.

University of Queensland and Griffith University researchers have developed a “global energy tracker” which predicts average world temperatures could climb 1.5C above pre-industrial levels by 2020. That forecast, based on new modelling using long-term average projections on economic growth, population growth and energy use per person, points to a 2C rise by 2030.

The UN conference on climate change in Paris last year agreed to a 1.5C rise as the preferred limit to protect vulnerable island states, and a 2C rise as the absolute limit. The more the economy grows, the more energy you use … the conclusion really is that economists and environmentalists are on the same side and have both come to the same conclusion: we’ve got to act now and we don’t have much time.”

Wagner said the model suggested the surge in energy consumption was not offset by improvements in energy efficiency. He said energy use per person was on track to rise six fold by 2050, which had dire implications for temperatures when combined with economic growth of 3.9% a year (the six-decade average) and a world population of 9 billion. “Massive increases in energy consumption would be necessary to alleviate poverty for the nearly 50% of the world’s population who live on less than $2.50 a day. “We have a choice: leave people in poverty and speed towards dangerous global warming through the increased use of fossil fuels, or transition rapidly to renewable.”

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