

Impact of ozone

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Ozone, a life saving layer has a great importance for human life on the earth surface. On one side it belongs to the field of environmental chemistry, while on the other hand it is of great interest not only to climatologists and meteorologist but also to physicist. In environmental chemistry, we discuss the chemical aspects of ozone with special reference to biotic and abiotic factors. In climatology and meteorology, we study the composition and location of ozone in atmosphere with relation to its impacts on human and physical environment.

Environmental chemistry deals with the study of the various chemical phenomena occurring in the atmosphere. Meteorology is a branch of physical science, in which we study every object connected to atmosphere. Moreover, the study of weather phenomenon of a specific area for a given time period is termed as climatology. These three broad fields of physical science along with atmospheric physics is generally related to the study of stratospheric ozone, its depletion and impacts on human environment.

The ocean of air, which covers the surface of the earth, is termed as atmosphere. The vertical extent of the atmosphere is difficult to ascertain, for it has no sharp boundary with extra-terrestrial space. Atmospheric phenomena associated with the earth's magnetic and gravitational fields extend outward for several thousand kilometres to vague zone of nebulous gasses and radiation particles that become rarer and rarer till the last terrestrial characteristics of the atmosphere.

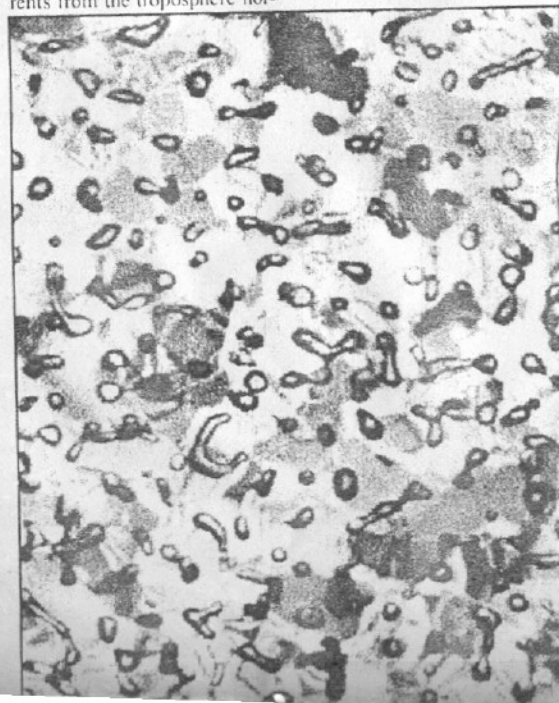
The atmosphere exhibits vertical temperature properties in five major layers or shells i.e. the troposphere, stratosphere, mesosphere, thermosphere and exosphere. Based on composition, structure and properties of atmospheric components, it may be divided into five layers i.e. hemispheres.

ic segment the temperature decreases with altitude upto tropopause, which is the mid-layer between troposphere and stratosphere. Stratosphere is the second layer of atmosphere, extended from 16km to 50 km. In the lower part of this segment, there is ozone, which has more importance for human activities. At poles the ozone layer is located at an altitude of about 8-15km, while at equator it is about 16-25km. In stratosphere the temperature altitude curve shows a warming trend with increasing altitude i.e. it exhibits negative lapse rate. The temperature in this region continues to increase with height, until 50km, where the temperature attains a maximum of -2 degree Celsius. This warming up tendency in the stratosphere is due to the absorption of UV radiation by ozone, whose concentration in this layer is 1-5 ppm by volume and this is responsible for the negative lapse rate. The air in this region is very dry and the clouds and convection currents from the troposphere nor-

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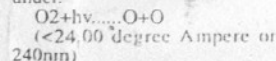
mally do not penetrate into it. The presence of ozone in the stratosphere serves as a shield to protect life on the earth from the harmful effects of solar UV radiation. The molecules and particles in this region have long residence time.

The term ozone derived from a Greek word "ozein" which literally means "Smell". It is an allotropic form of blue gas with a pungent smell. Van Marum first noticed the odour of ozone in 1785, when an electric discharge passed through air. Schonbiem in 1840 attribute this smell to the formation of a new gas, ozone. Soret established the formation of which to be ozone in 1860.



In 1857 Siemsen constructed the first machine to utilise the ozonator-discharge principle of ozone, and that device, later modified and improved by many others in the prototype of commercial ozone generating machine.

The microwave studies made by Trambarius (1953) and Huges (1956) have shown Ozone molecule in V-shaped with a bond angle 116.8 degree and O-O bonds length 1.278 degree Angstrom. This bond length is intermediate between that for a high bond (=1.48 degree Angstrom in H2 O2) and for a double bond (=1.21 degree Angstrom in Oxygen molecule). Ozone is the most abundant i.e. 90% of the total atmosphere, between 16-25 km above the surface of the earth. It is interesting to note that there is about 5 billion tones of ozone in this layer. For centuries, nature has maintained a level of concentration of stratospheric ozone creation and annihilation process in the stratosphere. It is formed in the stratosphere when high-energy ultraviolet radiation split normal oxygen molecule into atomic oxygen. The atomic oxygen may then combine with a standard diatomic oxygen molecule to form triatomic ozone. The chemical process of ozone formation is stated as under.



The stratospheric ozone is essential to preservation of current forms of life on the earth's surface. It acts as a shield that absorbs biologically dangerous UV-B radiation's. UV radiation is commonly divided into two bands: UV-A, has wavelength of 320-400 nm, UV-B, has a wavelength less than 320 nm and UV-C constitutes a shortest wavelength of UV

atomic oxygen, while giving off heat. This keeping away the UV radiation from reaching earth's surface and also causes a temperature inversion in stratosphere that help to maintain relatively stable climate condition on and near the ground surface.

Ozone on one hand absorbs the more dangerous UV radiation, while on another side it also absorb 0.000001 micron of solar energy in atmosphere. The wavebands UV-B and UV-C can cause potential damage to human as well as plant life because they can produce strong effects on both protein and nucleic acids. The waveband UV-B is also referred as biologically active UV rays. The Ultraviolet radiation causes thickening of the epidermis, pigmentation and Vitamin-D production due to sunburn of human skin. It also causes actinic elastosis and photogenic diseases due to the chronic processes of UV radiation. The most dangerous are non-melanoma skin cancer, actinic keratosis, squamous cell cancer and melanoma, which mostly cause by carcinogenic processes. In spite of this, xeroderma pigmentosum and albinism etc along with kwashiorkor and pellagra etc. are nutritional diseases, which mostly leads to UV radiation.

It may be emphasised that the effects of UV radiation on human life have been studied using selective or very narrow waveband of ultraviolet radiation from artificial resources. It is the major cause of sunburn, skin cancer and related problems are more common in western countries owing to the fairer skin colour. The human body does possess a biochemical mechanism for repair of cell damage by UV radiation but is also absent in rare cases of xeroderma pigmentosum, a hereditary disease. The exposure

different new infections.

A number of animals have natural physical barriers which prevents their skin from harmful UV radiation e.g. shell of gastropod, exoskeleton of insects, feathers and hairs etc. The dark colour of skin also help to minimise the effect of UV radiation. Many small organisms live much below the surface of the ground where UV radiation can not penetrate. In spite of all these factors the animal's life is not fully protected from dangerous of increased UV exposure.

Marine life also vulnerable to harmful UV radiation because the process of food making depends on a number of parameters such as its depth, amount and type of the suspended and dissolved materials in it. The UV radiation penetrates only the surface water and therefore the sea organisms living with in 5m depth of water potential risk.

Ozone is also a life saving layer for natural vegetation because UV radiation, which mostly absorbs by ozone in atmosphere, affected the plant growth and its production over the surface of the earth. The detail account of effects of UV-B radiation on crop yield is available only for one or two crops. Field studies at the university of Maryland (U.S.A.) have suggested that a reduction of 20-25% in the soybean crop yield will occur for 25% depletion of ozone layer. The application of these results to other important crops, such as wheat, maize and rice, clearly indicates that global food production will drastically declined with continued depletion of the ozone layer.

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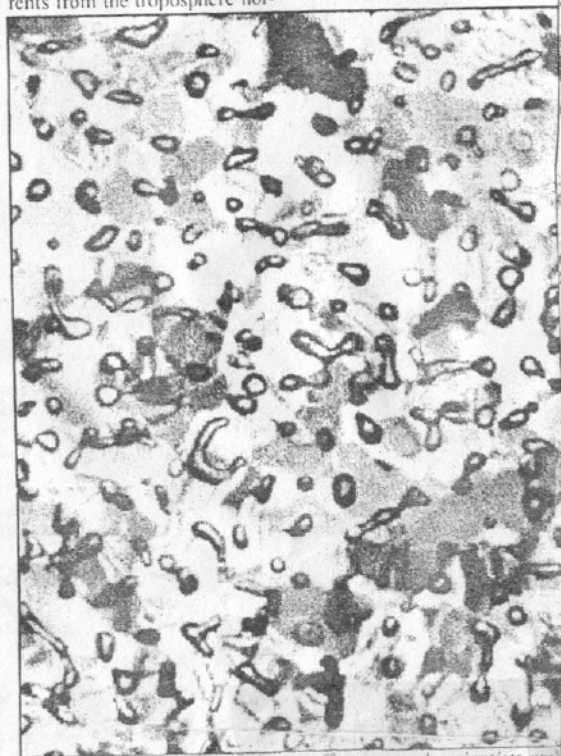
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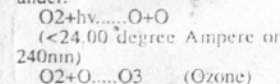
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As part of worldwide greenhouse-effect research, scientists examine Antarctic ice to study the atmospheric concentration of methane, a contributor to global warming. Air pockets trapped in the ice, such as those seen in this micrograph, are analyzed to determine the amount of methane found in them. The methane trapped in the ice can be used to determine the amount of methane in the atmosphere with that of previous ages, which contained less human-generated pollution.

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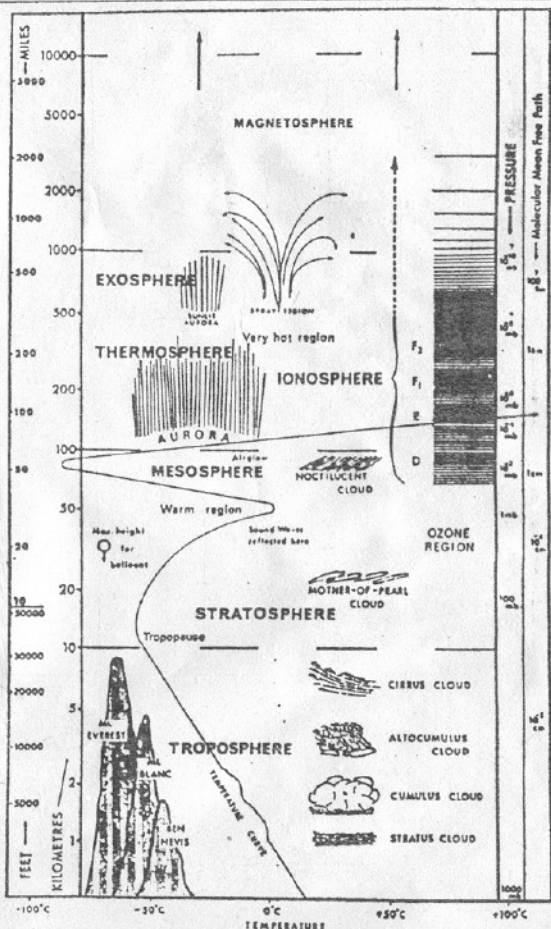
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As for as Pakistan is concern, where the annual cycle of rainfall shows some change from the previous seven years. The summer rains are continuously going to increase, while the winter rains, which are mostly brought by westerly current decreases. None of the individuals knows about this natural modification of the physical environment. However, hypothesis can be made here i.e. this change in the annual cycle of rainfall, particularly in winter rains mostly caused by the affects of Golf and Afghan wars. These crises created serious environmental problem due to the use of highly explosive materials. These explosive materials pro-

carbon compounds not only affects the temperature, humidity, rainfall and evapotranspiration of this region but it also increased the rate of UV radiation over these areas. But due to lack of facilities and data restriction further study on this hypothesis seems impossible.

The ozone layer in general, affected by chlorine, NOx, hydroxyl radical, bromine, freon gases (CF3), methane, ethane and other hydrocarbons, which is mostly released by vehicle and industries to atmosphere. The above discussion shows that the presence of ozone layer in atmosphere is a guarantee of life on the earth surface.

This zone mostly absorbs the UV radiation and saves humanity from dangerous diseases. The hydrocarbons, which are in general release to atmosphere by industries, vehicles and other explosive materials, are more affective to ozone. Therefore, it is necessary to control all those industries, vehicles and other explosive materials, which are releasing these materials into the atmosphere.

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This zone mostly absorbs the UV radiation and saves humanity from dangerous diseases. The hydrocarbons, which are in general release to atmosphere by industries, vehicles and other explosive materials, are more affective to ozone. Therefore, it is necessary to control all those industries and improve vehicle, which release gases to atmosphere and affected ozone layer. Also to stop Golf and Afghan wars immediately for the saving of the physical environment of the south-west Asia and the Middle East, otherwise a more severe condition will