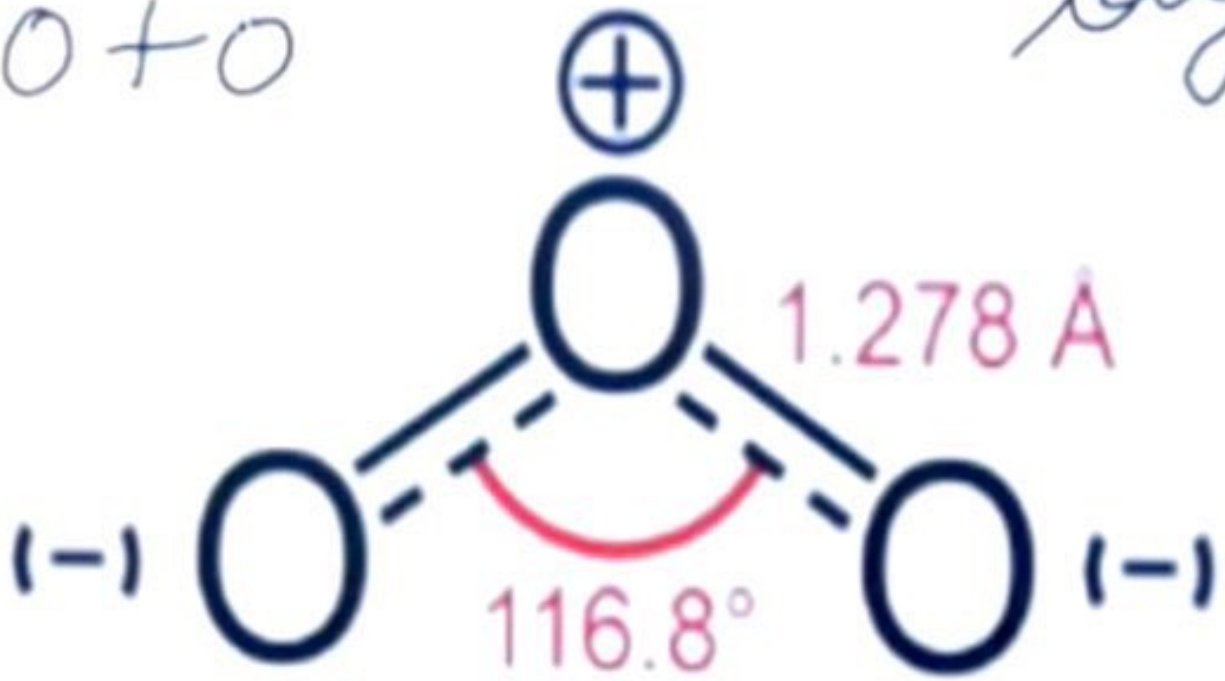
OZONE LAYER DEPLETION

→ O + O



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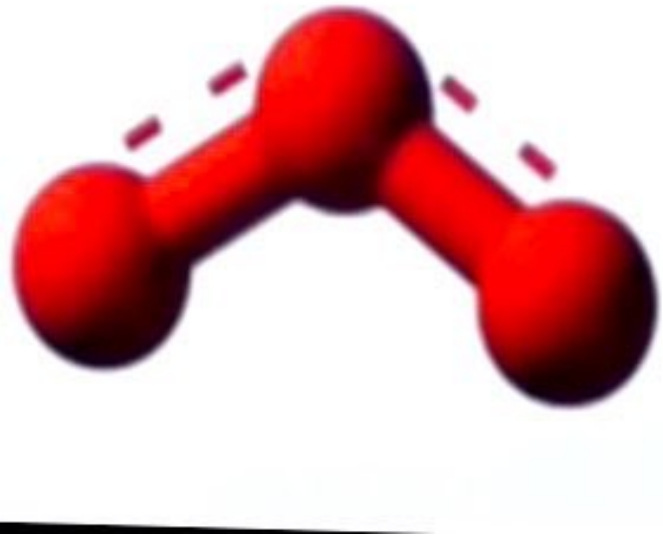
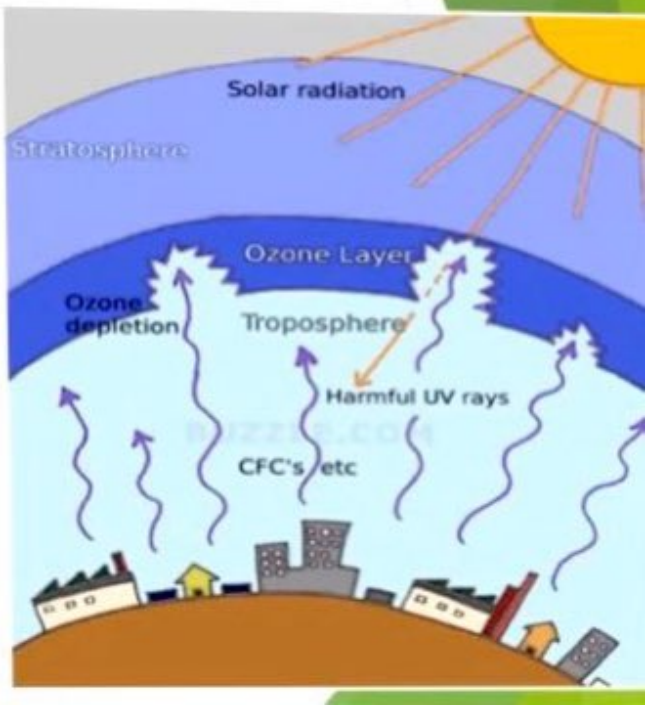


Ozone or trioxygen, is an inorganic molecule with the chemical formula o_3.
It is a pale blue gas with a distinctively pungent smell
It is an allotrope of oxygen that is much less stable than the diatomic allotrope O_2
breaking down in the lower atmosphere to O_2
(dioxygen)
It is slightly soluble in water
The ozone layer was discovered in 1913 by two French physicists Charles Fabry and Henri Buisson.

The ozone layer is found in the lower portion of the earth's atmosphere. It has the potential to absorb around 97-99% of the harmful ultraviolet radiations coming from the sun that can damage life on earth. If the ozone layer was absent, millions of people would develop skin diseases and may have weakened immune systems.

However, scientists have discovered a hole in the ozone layer over the Antarctic. This has focussed their concern on various environmental issues and steps to control them. The main reasons for the ozone hole are chlorofluorocarbons, carbon tetra chloride, methyl bromide and hydro chlorofluorocarbons.

- Ozone is basically an allotrope of oxygen , which has three atoms of oxygen .
- Ozone is found in two layers of the atmosphere , in the troposphere – bad ozone and in the stratosphere – good ozone .
- The ozone layer , in the stratosphere , protects the earth from the harmful radiations of the sun . It is very important and critical to the existence of life forms on Earth .
- Pollutants like CFC's , oxides of nitrogen and hydrocarbons cause the depletion of ozone layer . This phenomenon of gradual depletion of the protective ozone layer in the stratosphere , is termed as ozone layer depletion .



Source

The photochemical mechanisms that give rise to the ozone layer were discovered by the British physicist Sydney Chapman in 1930. Ozone in the Earth's stratosphere is created by ultraviolet light striking ordinary oxygen molecules containing two oxygen atoms (O_2), splitting them into individual oxygen atoms (atomic oxygen); the atomic oxygen then combines with unbroken O_2 to create ozone, O_3. The ozone molecule is unstable (although, in the stratosphere, long-lived) and when ultraviolet light hits ozone it splits into a molecule of O_2 and an individual atom of oxygen, a continuing process called the ozone-oxygen cycle. Chemically, this can be

described as:

$$O_2 + h\nu_{uv} \rightarrow 2\,O$$

$$O + O_2 \leftrightarrow \quad O_3$$

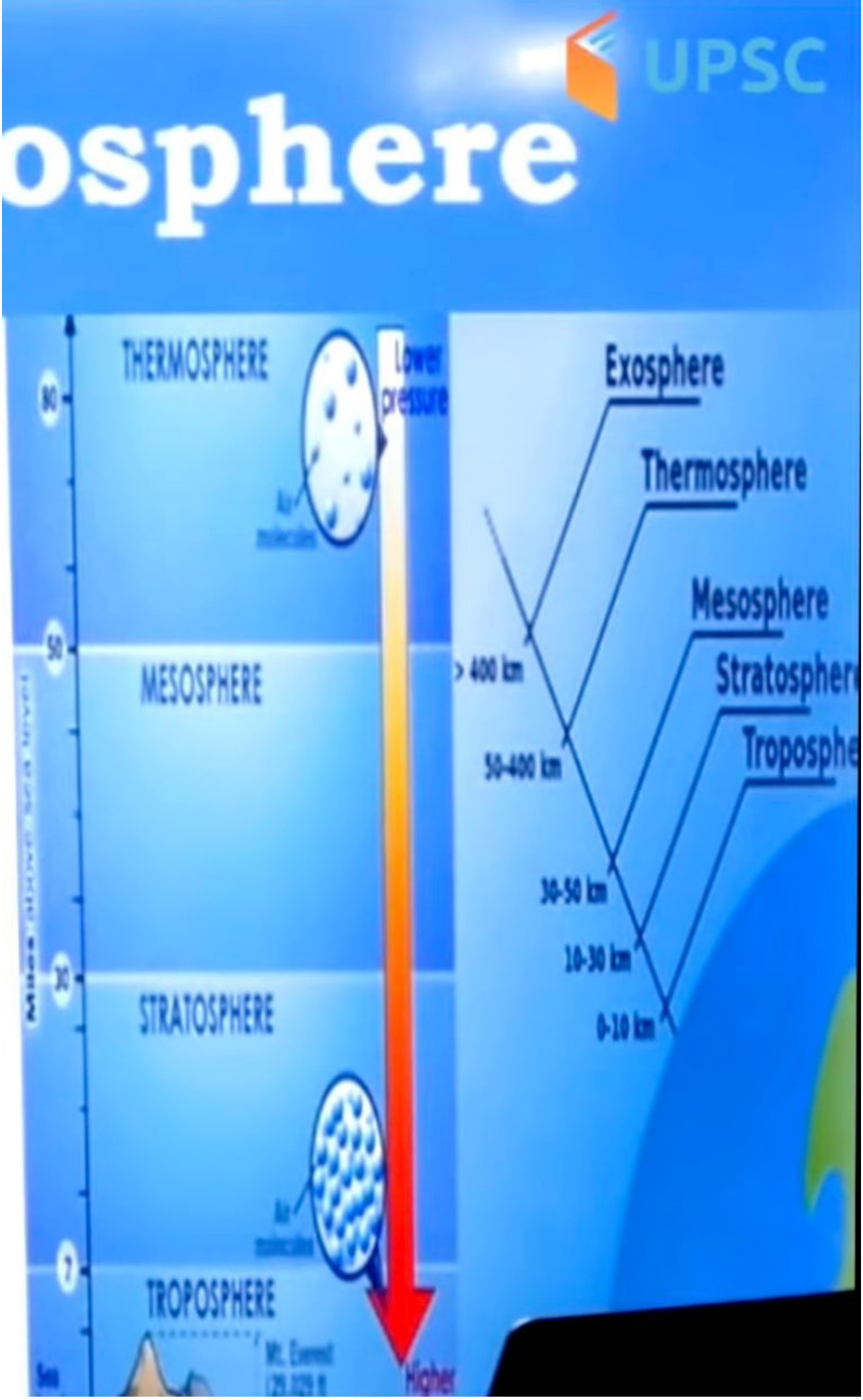
About 90 percent of the ozone in the atmosphere is contained in the stratosphere. Ozone concentrations are greatest between about 20 and 40 kilometres (66,000 and 131,000 ft), where they range from about 2 to 8 parts per million. If all of the ozone were compressed to the pressure of the air at sea level, it would be only 3 millimetres (1/8 inch) thick.

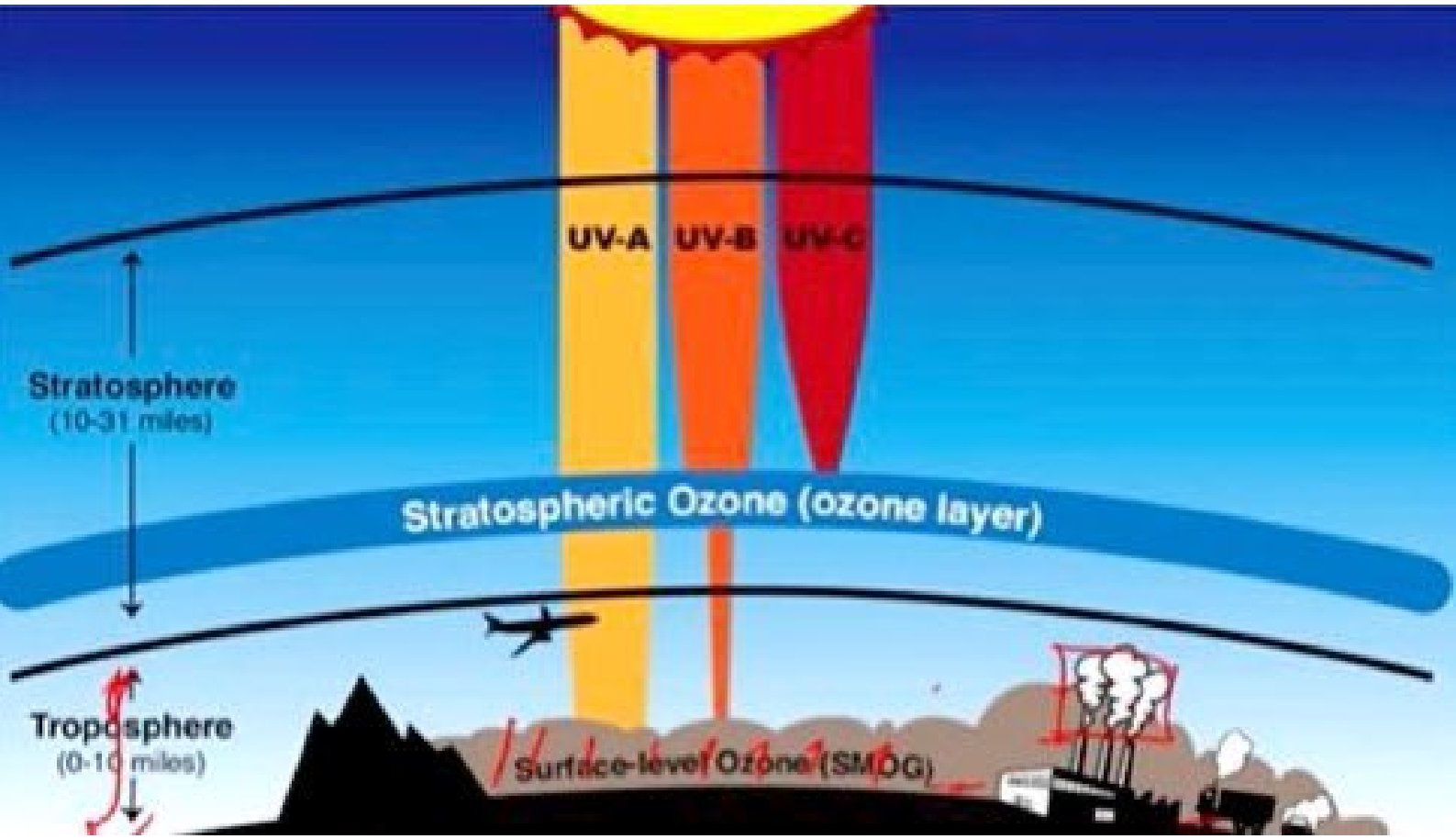
In lower atmosphere (troposphere) ,ozone is present as green house gas with some GWP and life span and so contribute greatly in the global warming.

Tropospheric ozone is directly emitted by car engine and industrial activity .

But, in upper atmosphere (stratosphere) it act as protective laye by absorbing the harmful UV rays, coming from the sun directly

In stratosphere ozone is present btw 20 to 30 km from the surface.





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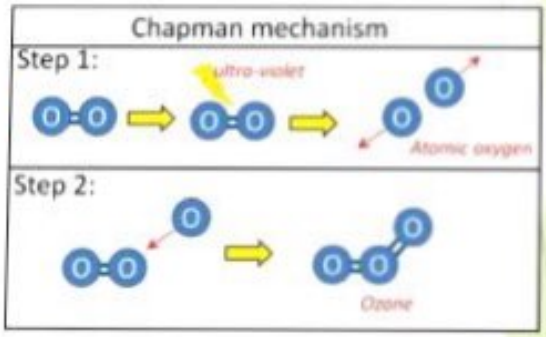
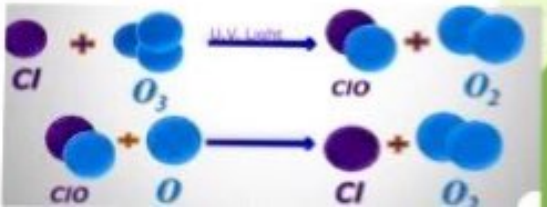
CAUSE OF OZONE LAYER DEPLETION

- The equilibrium between the formation and destruction of ozone has been upset by the influx of several substances like CFC's , HCFC's etc. into the atmosphere which react with ozone and destroy it .
- So the rate at which ozone is being destroyed is far much more than the rate at which it is being produced .
- This results in the significant decrease in concentration of ozone in a particular region , and hence , ozone holes are formed .





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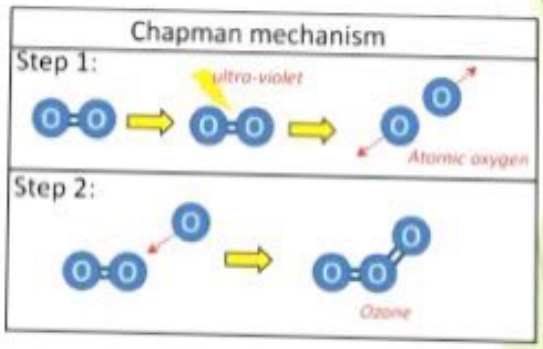
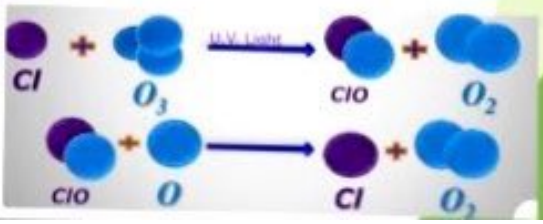
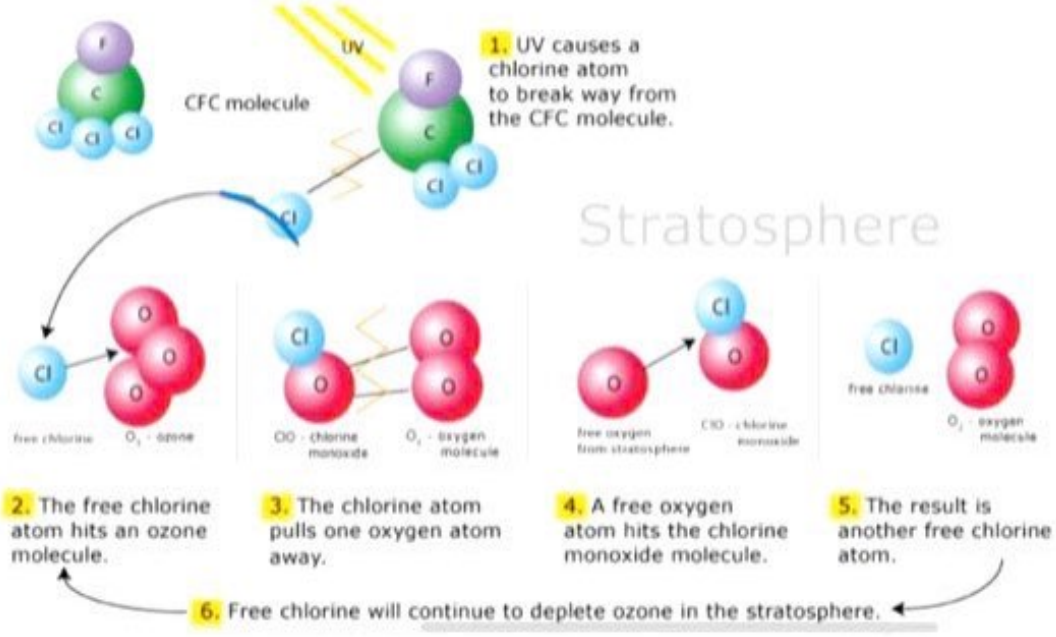


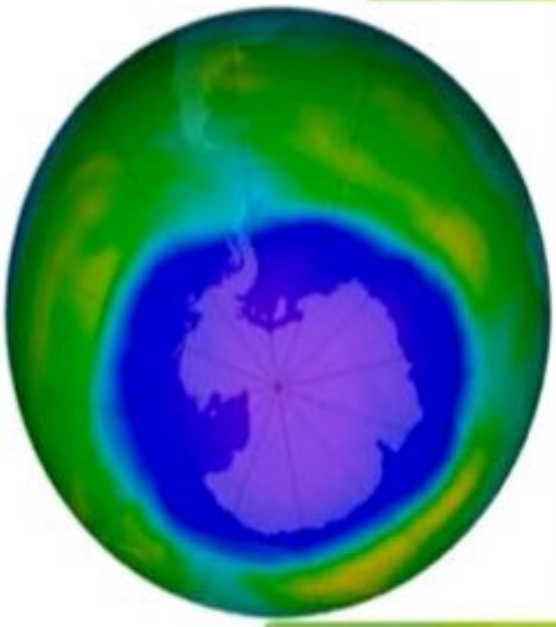


MECHANISM OF OZONE LAYER DEPLETION



OZONE HOLE

- The best example of the ozone hole in the atmosphere is over Antarctica , which has only about 50% of the ozone that originally existed there .
- The temperature at South Pole is lower than that at the North Pole , during winter the temperature at the south pole comes down to -40°C . The low temperature , helps in formation of ice crystals , HCL gas in the presence of ice crystals breaks into chlorine molecule and then dissociates into chlorine atom which reacts with ozone . The extreme cold at the south pole helps in forming ice crystals to facilitate the reaction .



- The ozone measurement instruments and technique are varied. Some of them are the Dobso spectrophotometer and the filter ozonometer calle M83, and total ozone mapping spectrometer (TOMS) in the Nimbus-7 satellite.
- ओजोन मापक यंत्र और तकनीक विविध हैं। उनमें से कुछ Dob स्पेक्ट्रोफोटोमीटर और फिल्टर ozonometer M83, और Nimbus-7 उपग्रह में कुल ओजोन मानचित्रण स्पेक्ट्रोमीटर (TOMS) हैं।
- Dobson – named after Gordon Dobson
- डॉबसन का नाम गॉर्डन डॉब्सन के नाम पर रखा गया

EFFECTS OF OZONE LAYER DEPLETION

- Depletion of the ozone layer would result in an increase in the ultraviolet radiations reaching the earth's surface causing direct as well as indirect effects .

DIRECT EFFECTS

1) The ozone absorbs heat from the sun which results in increase of temperature in the stratosphere . The reduction in ozone , would lead to temperature changes and rainfall failures on the earth .
2) One percent reduction in ozone , increase UV radiation reaching on the earth by 2% . It further leads to harmful effects like :-
   - Reduction in immunity .
   - Increase in incidence of cancers and cataracts .
   - Genetic Disorders .

EFFECTS OF OZONE LAYER DEPLETION

INDIRECT EFFECTS

1) Reduction in plant growth , reduction in chlorophyll content .
2) Increase in mutations .
3) Disturbance of ecological balance .
4) Alter physical and chemical properties of substances for example plastics become brittle when exposed to harmful UV radiations .

Effects Of Ozone Layer Depletion

The depletion of the ozone layer has harmful effects on the environment. Let us see the major effects of ozone layer depletion on man and environment.

Effects on Human Health

The humans will be directly exposed to the harmful ultraviolet radiations of the sun due to the depletion of the ozone layer. This might result in serious health issues among humans, such as skin diseases, cancer, sunburns, cataract, quick ageing and an weakend immune system.

Effects on Animals

Direct exposure to ultraviolet radiations leads to skin and eye cancer in animals.

Effects on the Environment

Strong ultraviolet rays may lead to minimal growth, flowering and photosynthesis in plants. The forests also have to bear the harmful effects of the ultraviolet rays.

Effects on Marine Life

Planktons are greatly affected by the exposure to harmful ultraviolet rays. These are higher in the aquatic food chain. If the planktons are destroyed, the organisms present in the lower food chain are also affected.

Solutions to Ozone Layer Depletion

The depletion of the ozone layer is a serious issue and various programmes have been launched by the government of various countries to prevent it. However, steps should be taken at the individual level as well to prevent the depletion of the ozone layer.

EFFORTS TO CHECK OZONE DEPLETION

- Numerous international programmes have been taken up in order to reduce the CFC production .
- Alternative technologies like ***ICE CLEANING*** (a semiconductor washing device , which uses frozen alcohol and ice at temperatures below -50°C to blow off dust)and phaseout schedules are also helpful .

INTERNATIONAL PROGRAMMES

- VIENNA CONFERENCE – first global conference , to discuss the phenomenon . Held in Vienna , Austria in 1985 . When the ozone hole was first discovered .
- MONTREAL PROTOCOL – Held in 1987 . Developed countries decided to reduce CFC production step by step . Assured to provide assistance in switching to alternative technologies to developing countries .
- SAVING THE OZONE LAYER CONFERENCE – Held in London in 1989 . Organised by the British Government and the UNEP . Stressed the final withdrawal of all ozone depleting substances .
- HELSINKI CONFERENCE – Held in May , 1989 . To revise the Montreal Protocol . An agreement on eliminating CFC .