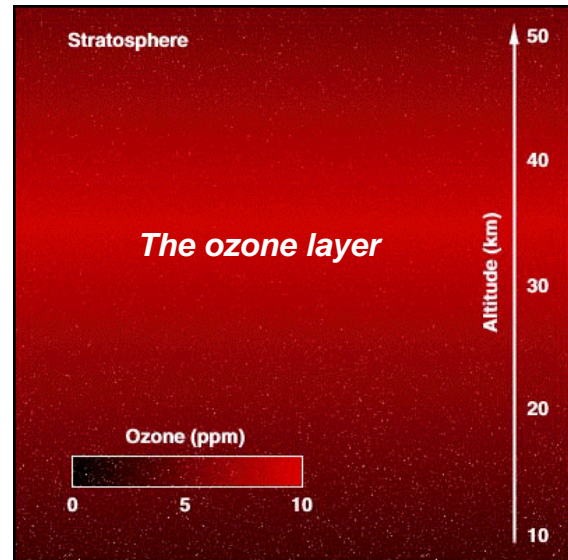


3. The Ozone Layer

Introduction

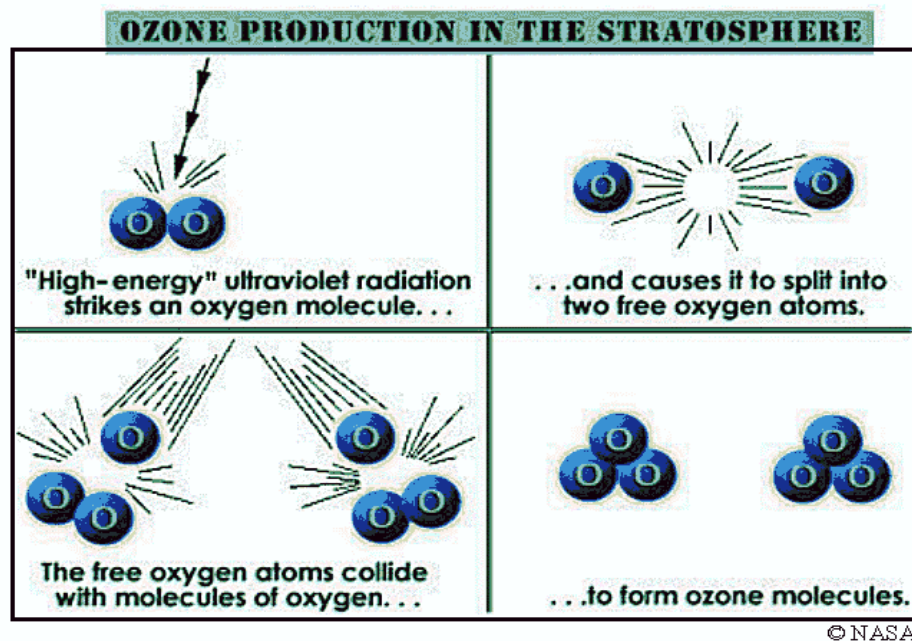
The ozone layer is a layer of ozone particles scattered between 19 and 30 kilometres (12 to 30 miles) up in the Earth's atmosphere, in a region called the stratosphere. The concentration of ozone in the ozone layer is usually under 10 parts ozone per million. Without the ozone layer, UV radiation would not be stopped from entering the Earth's atmosphere and arriving at the surface, causing untold damage to most living species. In the 1970s, scientists discovered that chlorofluorocarbons (CFCs) could destroy ozone in the stratosphere. Since CFCs had been in use as refrigerants, coolants, and propellants for aerosol cans since the 1930s, this posed a major problem.



The Formation of Stratospheric Ozone

Ozone is created in the stratosphere when highly energetic solar radiation strikes molecules of oxygen (O_2) and cause the two oxygen atoms to split apart. If a freed atom bumps into another O_2 , it joins up, forming ozone (O_3). This process is known as photolysis. Ozone is also naturally broken down in the stratosphere by sunlight and by a chemical reaction with various compounds containing nitrogen, hydrogen and chlorine. These chemicals all occur naturally in the atmosphere in very small amounts.

In an unpolluted atmosphere there is a balance between the amount of ozone being produced and the amount of ozone being destroyed. As a result, the total concentration of ozone in the stratosphere remains relatively constant. At different temperatures and pressures (i.e. varying altitudes within the stratosphere), there are different formation and destruction reaction rates. Thus, the amount of ozone within the stratosphere varies according to altitude. Ozone concentrations are highest between 19 and 23 km.



Distribution of Stratospheric Ozone

Most of the ozone in the stratosphere is formed over the equatorial belt, where the level of solar radiation is greatest. It is transported by latitudinal air movements towards polar latitudes. Consequently, the amount of stratospheric ozone above a location on the Earth varies naturally with latitude, season, and from day-to-day. Under normal circumstances highest ozone values are found over the Canadian Arctic and Siberia, whilst the lowest values are found around the equator. The ozone layer over Canada is normally thicker in winter and early spring, varying naturally by about 25% between January

and July. Weather conditions can also cause considerable daily variations.

It is generally believed that if the stratospheric ozone concentration is disturbed, it takes some time for the chemical system to return to its original balance or new equilibrium (between formation and destruction). The time this takes depends on the altitude in the stratosphere. Above 40km, it may take a few minutes for an equilibrium to be re-established, while below 30 km altitude it can take several days.

To summarise, ozone is constantly produced and destroyed in the stratosphere, by reactions involving sunlight and oxygen. It is a mistake to think of it as a finite resource, like oil, that can be destroyed once and for all. What could happen is that the balance of the present equilibrium that exists to maintain the layer may be shifted, either in favour of less ozone or more.

Why is the Ozone Layer Important?

Ozone's unique physical properties allow the ozone layer to act as our planet's sunscreen, providing an invisible filter to help protect all life forms from the Sun's damaging ultraviolet (UV) rays. Most incoming UV radiation is absorbed by ozone and prevented from reaching the Earth's surface. Without the protective effect of ozone, life on Earth would not have evolved in the way it has.