

# OZONE LAYER DEPLETION & PROTECTION



**Moly P P**  
**Dept.of Chemistry**

# Highpoints:

**What is it?**

**Where is it?**

**Why is it important to life on Earth?**

**How are we as humans affecting it?**

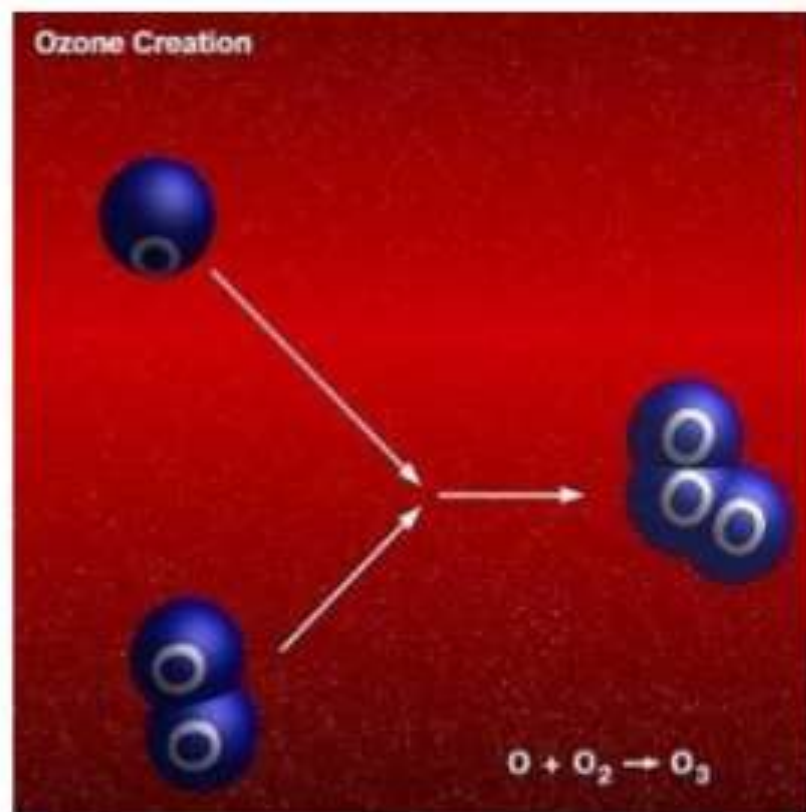
**why is the ozone layer important to life on Earth?**

**How are we as humans affecting the ozone layer?**

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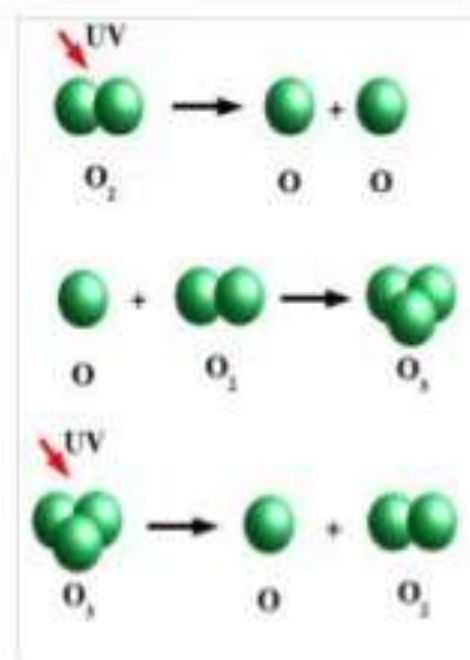
# What is the ozone layer?

- The ozone layer is a layer of gas consisting of  $O_3$  molecules, called ozone, that forms when free Oxygen molecules bond to  $O_2$  molecules.



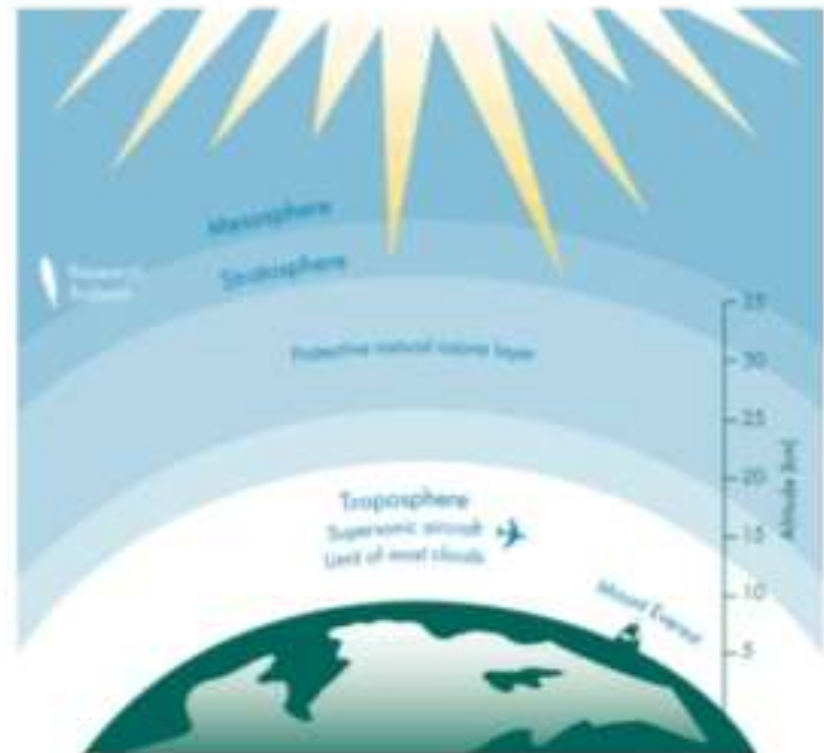
# Ozone:

- Ozone is a molecule consisting of oxygen atoms.
- Ozone gas can be created or destroyed by the sun's UltraViolet rays as shown in the picture to the right.



# Where is the ozone layer?

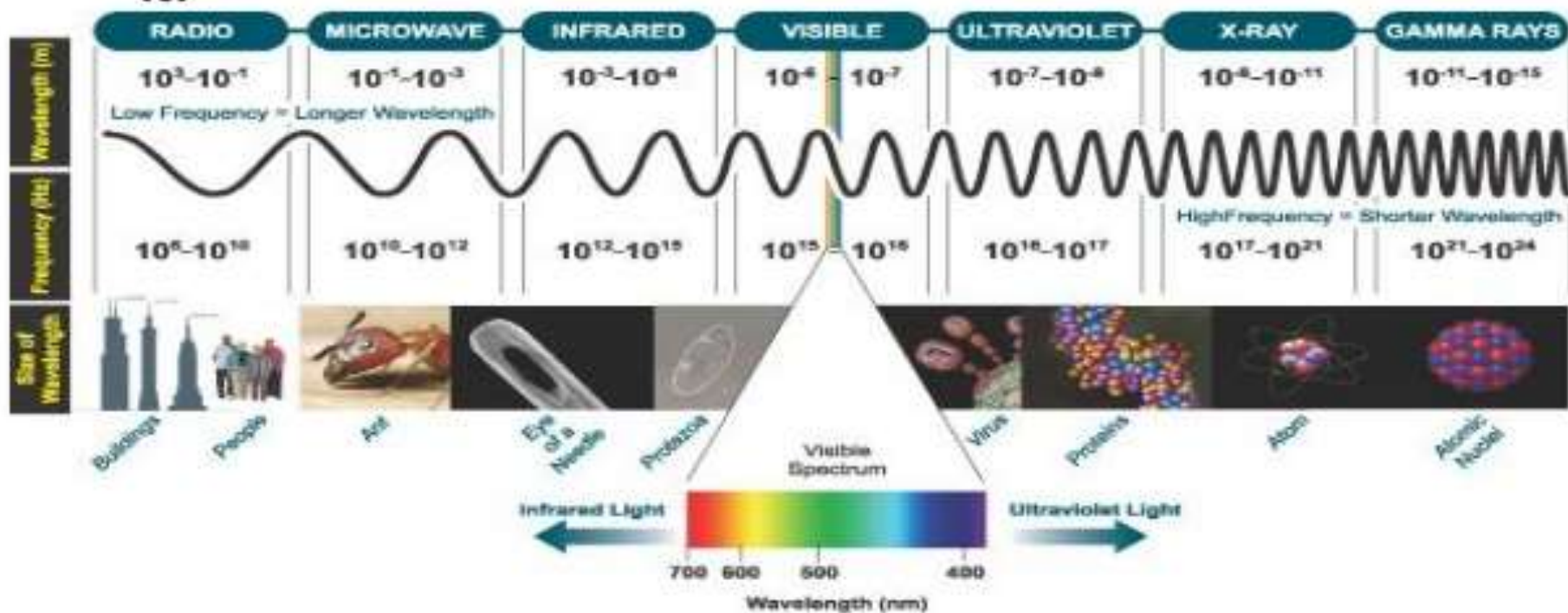
- The ozone layer is a protective layer of gas molecules located within the stratosphere.
- Ozone gas also exists in the troposphere and at ground level, but most is located within the stratospheric layer shown to the right.





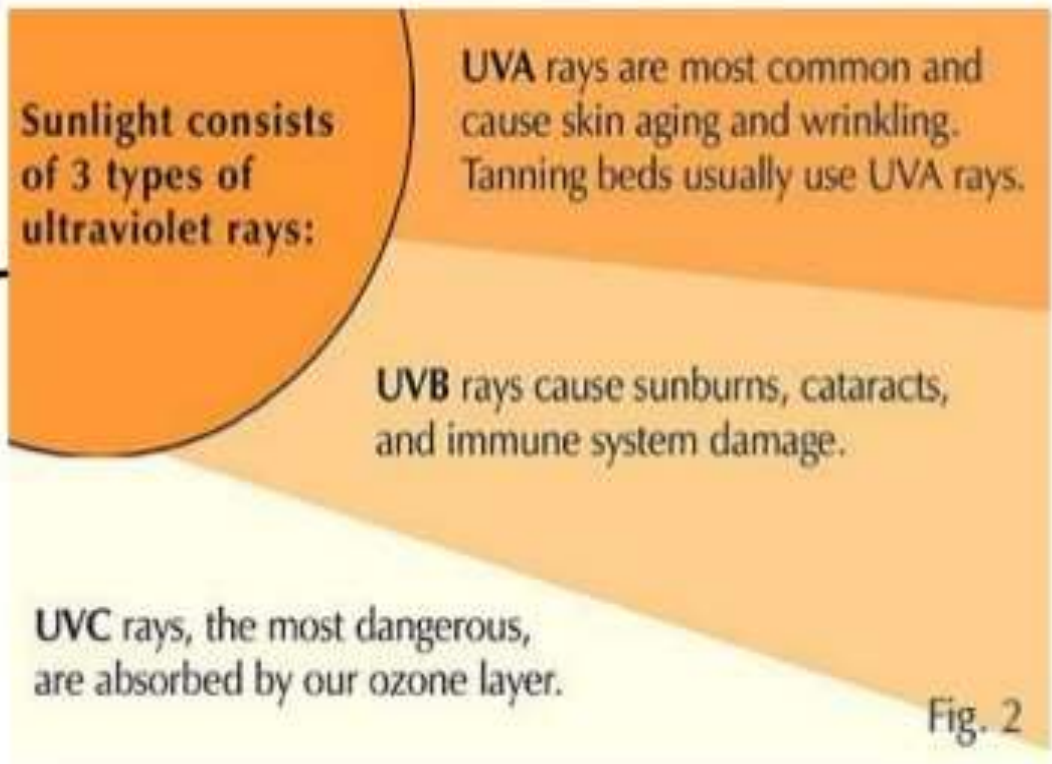
# Why is it important to life on Earth?

- On a daily basis, the sun radiates its energy toward Earth. One form of this energy is UltraViolet radiation, also known as UV rays.
- UV rays are relatively high energy waves that provide Earth with the warmth it needs to support life as we know it.



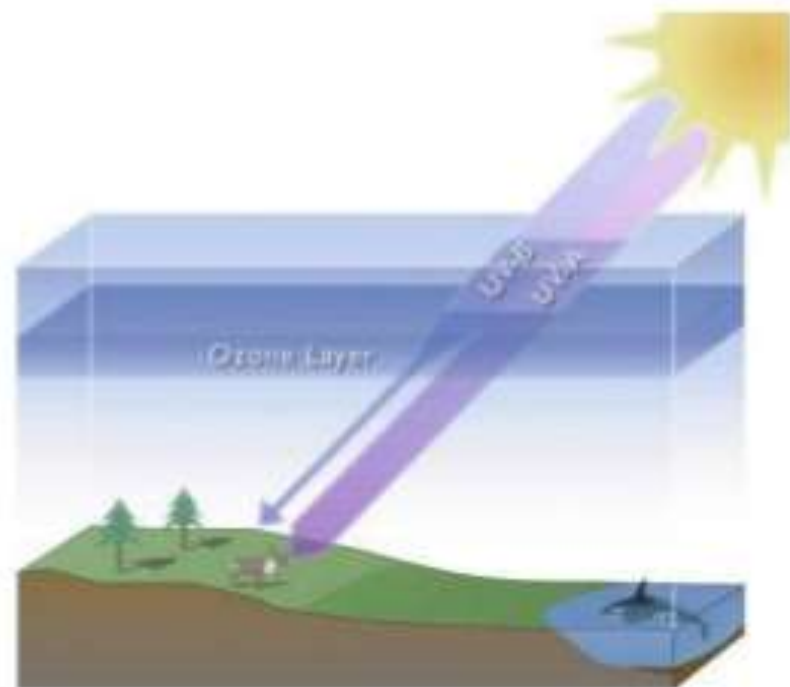
# Ultra-Violet Radiation

- **UV rays penetrate the Earth's atmosphere at 3 slightly different wavelengths called UV-A, UV-B, and UV-C rays.**



# So, why is the ozone layer important to life on Earth?

- The stratospheric ozone layer completely stops the penetration of UV-C rays and eliminates most of the UV-B rays.
- Therefore, the ozone layer protects life on Earth from the harmful effects of solar radiation on a daily basis.



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# So what might life be like without the ozone layer?

- Skin Cancer (melanoma and nonmelanoma)
- Premature aging of the skin and other problems
- Cataracts and other eye damage
- Immune system suppression



# How are we as humans affecting the ozone layer?

- **Since 1928, Chlorofluorocarbons have been produced, originally as nonflammable refrigerants for use in refrigerators, and eventually for use in fire extinguishers, dry cleaning agents, pesticides, degreasers, adhesives, and as propellants for aerosol products.**
- **As these CFCs have been released into the atmosphere, the level of ozone in the stratosphere has decreased.**
- **CFCs have an estimated lifespan of more than 100 years.**

# CFCs and Ozone

Ultraviolet radiation strikes a CFC molecule. . .



. . .and causes a chlorine atom to break away.



The chlorine atom collides with an ozone molecule. . .



. . .and steals an oxygen atom to form chlorine monoxide and leave a molecule of ordinary oxygen.



When a free atom of oxygen collides with the chlorine monoxide. . .

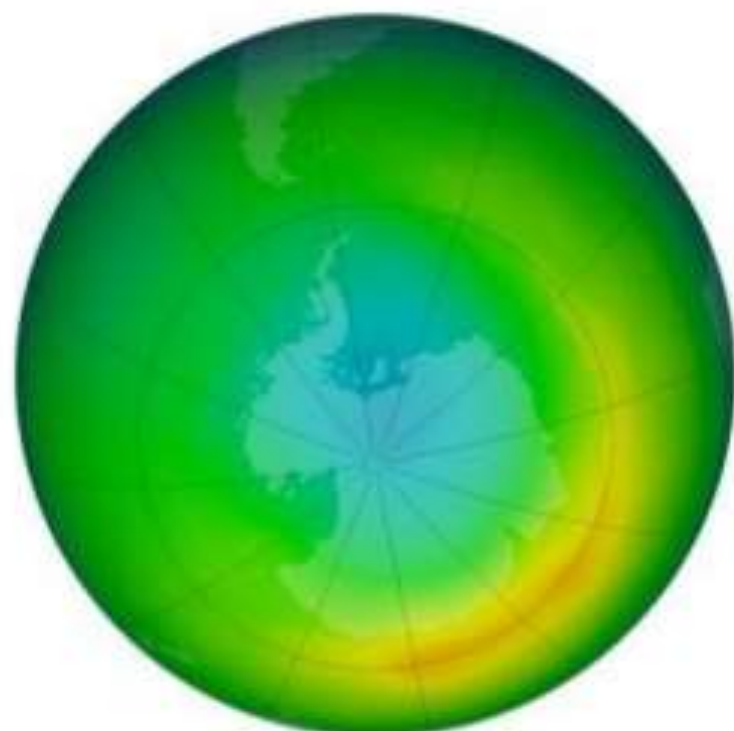


. . .the two oxygen atoms form a molecule of oxygen. The chlorine atom is released and free to destroy more ozone.



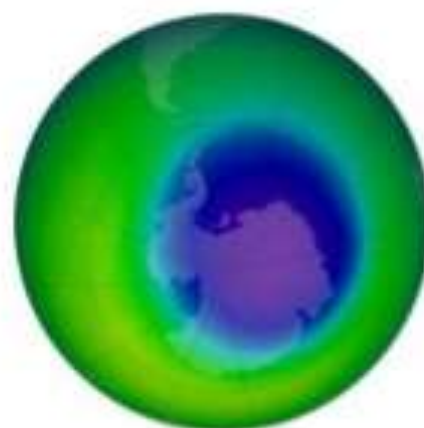


# So what about the hole in the ozone layer?



Total Ozone (Dobson Units)  
110 220 330 440 550

October 1979



Total Ozone (Dobson Units)  
110 220 330 440 550

October 2007



# The Ozone Hole

- **Since the 1970's the ozone hole has been increasing in size over the Antarctic.**
- **For the first time, in September of 2000, the ozone hole became so large it actually left populated areas of southern Chile fully exposed to the effects of the Sun's UV rays.**

## How does ozone depletion affect global warming and ultimately climate change?

- **As ozone levels in the stratosphere are depleted, more solar radiation penetrates the Earth's atmosphere.**
- **This affect results in an increase in solar radiation reaching the Earth's surface adding to an increase in surface temperature.**
- **In turn, global warming actually results in a warming of the troposphere, but a cooling of the stratosphere, hindering the ozone layer's natural chemistry for repairs.**

## How can we protect our self from the adverse effects of solar UV-B radiation on the skin?

**The intensity of UV-B radiation from the sun is usually highest during the central hours of the day (about 10 am until 2 pm) or later in periods of daylight savings).**

**If you are outside, it is most important to avoid sunburn. The time taken to reach this point depends on many variables including your ability to tan in response to sunlight. The popular advice “to slip (on a shirt), slap (on a hat), slop (on some sunscreen)” and wrap (add wrap-around sunglasses)**

Thank you