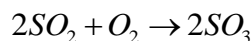
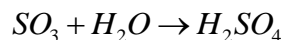


Impurities such as pyrite or iron pyrite are found in coal, when we burn coal it interacts with atmospheric oxygen to form iron oxide and sulfur dioxide (a primary air pollutant).



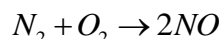
The primary air pollutant, sulfur dioxide, is *oxidized*, once in the atmosphere, to sulfur trioxide.



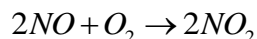
Sulfur trioxide dissolves in atmospheric water droplets to form sulfuric acid. Sulfuric acid is a major component of acid rain. Sulfuric acid is considered a secondary air pollutant



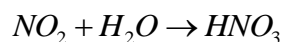
The generalized representation of sulfur oxides, whether it be sulfur dioxide or sulfur trioxide. The Sulfur oxides are considered primary air pollutants.



Molecules of nitrogen and atmospheric oxygen combine AT VERY HIGH TEMPERATURES to form nitric oxide, a colorless gas. The high temperatures of natural processes like lightening or those of the combustion chambers of an engine are effective in causing this conversion. Nitric oxide is a primary air pollutant



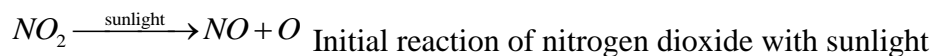
Once in the atmosphere, nitric acid reacts with additional oxygen to form nitrogen dioxide, a red-brown toxic gas that causes irritation to the eyes and respiratory system



Further reaction of nitrogen dioxide with water can produce nitric acid, another component of acid rain

### **Photochemical Smog**

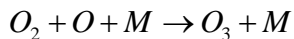
$N_2 + O_2 + Energy \rightarrow 2NO$  Nitrogen oxide is an essential ingredient of photochemical smog that is produced during the high temperatures associated with combustion of vehicle's engines.



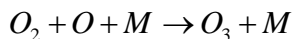
$O + O_2 \rightarrow O_3$  The oxygen atom generated from the initial reaction reacts with atmospheric, diatomic oxygen, to form ozone. This is not the good, protective ozone of the stratosphere, this is the polluting ozone of the troposphere, which traps heat and contributes to thermal inversion.



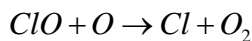
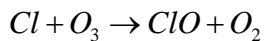
## Ozone Formation and Destruction



As sunlight penetrates into the stratosphere, high-energy UV photons react with oxygen gas molecules, splitting them into individual oxygen atoms. These highly reactive oxygen atoms are examples of *free radicals*; they quickly enter into chemical reactions that allow them to attain stable arrangements of electrons. In the stratosphere free radicals can combine with oxygen molecules to form ozone. A third molecule, typically nitrogen gas or atmospheric oxygen (represented by *M* in the equation), carries away excess energy from the reaction but remains unchanged.



Each ozone molecule formed in the stratosphere can absorb a UV photon with a wavelength of less than 320nm. This energy absorption prevents potentially harmful UV rays from reaching the earth's surface. The energy also causes the ozone to decompose, producing an oxygen molecule and an oxygen free radical. These products can then carry on the cycle by replacing ozone in the protective stratospheric layer.



CFC's (chlorofluorocarbons) are highly stable molecules in the troposphere, however, high-energy UV photons in the stratosphere split chlorine radicals from CFC's by breaking their C-Cl bond. The freed chlorine radicals are very reactive and can participate in a series of reactions that destroy ozone by converting it to diatomic oxygen. Every chlorine radical that participates in the first reaction can later be regenerated. Thus each chlorine radical acts as a catalyst participating in not just one, but also an average of 100,000 ozone-destroying reactions. In doing so, it speeds up ozone destruction but remains unchanged.