

### Atmospheric Profile

- Atmosphere extends to 32,000 km (20,000mi) from surface
- Exosphere's top is at 480 km (300 mi)
- Three criteria to examine atmosphere
  - Composition
  - Temperature
  - Function

### Atmosphere Profile of

Figure 3.2

### Atmospheric Pressure

Altitude (km)	Altitude (mi)	Pressure (mb)	Pressure (in.)	Pressure (%)
0	0	1013.2	29.92	100
5	3.1	507	14.96	50
10	6.2	101.3	2.99	10
15	9.3	11.9	0.35	1.2
20	12.4	1.9	0.055	0.2
30	18.6	0.3	0.009	0.03
40	24.8	0.03	0.0009	0.003

Figure 3.3

### Atmospheric Composition

- Homosphere – inner atmosphere
  - Surface to 80 km (50 mi)
  - Gases evenly blended
- Heterosphere – outer atmosphere
  - 80 km (50 mi) outwards
  - Layers of gasses sorted by gravity

**Table 3.2 Stable Components of the Modern Homosphere**

Gas (Symbol)	Percentage by Volume	Parts per Million (ppm)
Nitrogen (N <sub>2</sub> )	78.084	780,840
Oxygen (O <sub>2</sub> )	20.946	209,460
Argon (Ar)	0.934	9,340
Carbon dioxide (CO <sub>2</sub> )*	0.037	369.7
Neon (Ne)	0.001818	18
Helium (He)	0.000525	5
Methane (CH <sub>4</sub> )	0.00014	1.4
Krypton (Kr)	0.00010	1.0
Ozone (O <sub>3</sub> )	Variable	
Nitrous oxide (N <sub>2</sub> O)	Trace	
Hydrogen (H)	Trace	
Xenon (Xe)	Trace	

\*2000 average measured at Mauna Loa, Hawai'i (see: <http://cdiac.esd.ornl.gov/ftp/maunaloa-co2/maunaloa.co2>).

## Atmospheric Temperature

- Troposphere**
  - Surface to 18 km (11 mi)
  - 90% mass of atmosphere
  - Normal lapse rate – average cooling at rate of 6.4°C/km (3.5°F/1000 ft)

## Atmospheric Temperature

- Stratosphere**
  - 18 to 50 km (11 to 31 mi)
- Mesosphere**
  - 50 to 80 km (30 to 50 mi)
- Thermosphere**
  - Roughly same as heterosphere
  - 80 km (50 mi) onwards

## Atmospheric Function

- Ozonosphere**
  - Part of stratosphere
  - Ozone (O<sub>3</sub>) absorbs UV energy and converts it to heat energy
- Ionosphere**
  - Absorbs cosmic rays, gamma rays, X-rays, some UV rays

## Variable Atmospheric Components

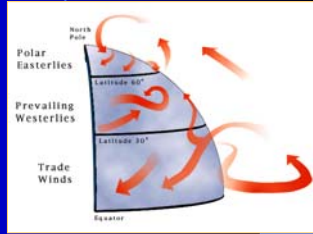
- Natural Sources**
- Natural Factors That Affect Air Pollution**
- Anthropogenic Pollution**

**Table 3.3 Sources of Natural Variable Gases and Materials**

Source	Contribution
Volcanoes	Sulfur oxides, particulates
Forest fires	Carbon monoxide and dioxide, nitrogen oxides, particulates
Plants	Hydrocarbons, pollens
Decaying plants	Methane, hydrogen sulfides
Soil	Dust and viruses
Ocean	Salt spray and particulates

## Natural Factors That Affect Air Pollution

- Winds
- Local and regional landscapes
- Temperature inversion-



Situation where a layer of warmer air exists above the Earth's surface in a normal **atmosphere** where air temperature decreases with altitude. In the warmer layer of air, temperature increases with altitude.

## Temperature Inversion

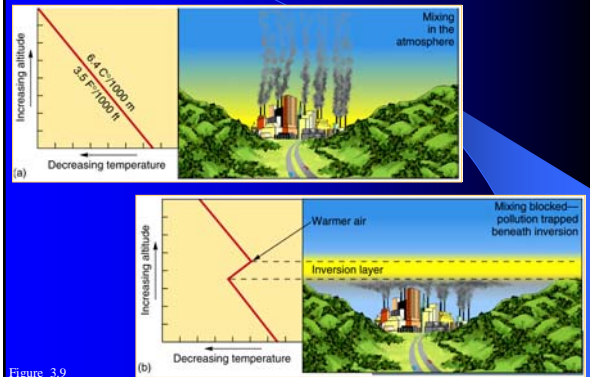


Figure 3.9

## Anthropogenic Pollution (Caused by Humans)

- Carbon monoxide
- Photochemical smog
- Industrial smog and sulfur oxides
- Particulates



## Pollution Sources

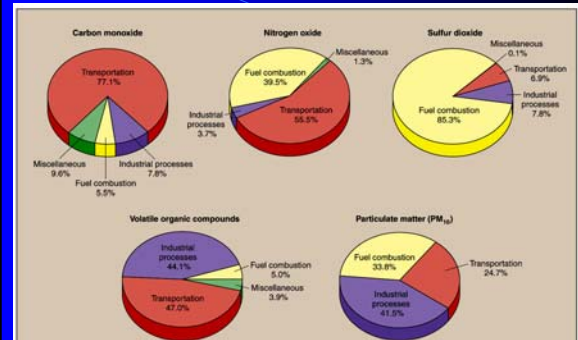


Figure 3.10

## Photochemical Smog

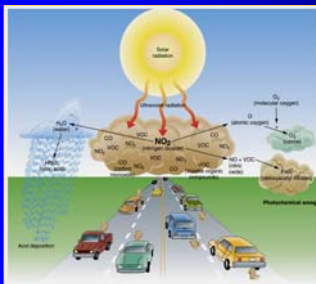


Figure 3.14

Photochemical smog is a condition that develops when **primary pollutants** (oxides of nitrogen and volatile organic compounds created from fossil fuel combustion) interact under the influence of **sunlight** to produce a mixture of hundreds of different and hazardous chemicals known as **secondary pollutants**.