Earth’s Modern Atmosphere

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

Atmospheric Pressure

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

- **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) outwards

Atmospheric Function

- **Ozonosphere**
  - Part of stratosphere
  - Ozone (O₃) 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 3.2 Stable Components of the Modern Homosphere

<table>
<thead>
<tr>
<th>Gas (Symbol)</th>
<th>Percentage by Volume</th>
<th>Parts per Million (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen (N₂)</td>
<td>78.084</td>
<td>780,480</td>
</tr>
<tr>
<td>Oxygen (O₂)</td>
<td>20.946</td>
<td>209,460</td>
</tr>
<tr>
<td>Argon (Ar)</td>
<td>0.934</td>
<td>9,140</td>
</tr>
<tr>
<td>Carbon dioxide (CO₂)*</td>
<td>0.037</td>
<td>369.7</td>
</tr>
<tr>
<td>Neon (Ne)</td>
<td>0.001818</td>
<td>18</td>
</tr>
<tr>
<td>Helium (He)</td>
<td>0.000525</td>
<td>5</td>
</tr>
<tr>
<td>Methane (CH₄)</td>
<td>0.00014</td>
<td>1.4</td>
</tr>
<tr>
<td>Krypton (Kr)</td>
<td>0.00010</td>
<td>1.0</td>
</tr>
<tr>
<td>Ozone (O₃)</td>
<td>Variable</td>
<td>Trace</td>
</tr>
<tr>
<td>Nitrous oxide (N₂O)</td>
<td>Trace</td>
<td></td>
</tr>
<tr>
<td>Hydrogen (H₂)</td>
<td>Trace</td>
<td></td>
</tr>
<tr>
<td>Xenon (Xe)</td>
<td>Trace</td>
<td></td>
</tr>
</tbody>
</table>


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

<table>
<thead>
<tr>
<th>Source</th>
<th>Contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volcanoes</td>
<td>Sulfur oxides, particulates</td>
</tr>
<tr>
<td>Forest fires</td>
<td>Carbon monoxide and dioxide, nitrogen oxides, particulates</td>
</tr>
<tr>
<td>Plants</td>
<td>Hydrocarbons, pollens</td>
</tr>
<tr>
<td>Decaying plants</td>
<td>Methane, hydrogen sulfides</td>
</tr>
<tr>
<td>Soil</td>
<td>Dust and viruses</td>
</tr>
<tr>
<td>Ocean</td>
<td>Salt spray and particulates</td>
</tr>
</tbody>
</table>
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

Anthropogenic Pollution (Caused by Humans)

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

Pollution Sources

Photochemical Smog

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.