

# Gases

## I. Pressure

- A. pressure is defined as the constant collisions between gas molecules and the walls of its container.
- B. Measured as a force per unit area.
  - 1. Units can be kilopascals, pounds per square inch (psi), atmospheres, and others.
  - 2. barometers are instruments used to measure atmospheric pressure; high pressure equates to fair days while low pressure indicates impending storms.

## II. Boyle's Law

- A. States that as the pressure on a gas increases, the volume of the gas

decreases. Additionally, as the pressure decreases the volume of the gas increases.

B. Formula:

C. Important to scuba divers who need to make sure the pressure outside of their body is the same as the pressure of the gas that they breathe.

### III. Charles's Law

A. States that as the temperature of a gas increases, so does its volume. Likewise, as the temperature of a gas decreases, so does its volume.

B. Formula:

C. Think of balloons in the summer and wintertime as an example of this change in volume.

D. Warmer air expands and has a smaller density, which makes it rise to higher altitudes. This is why the top floor of a house is warmer than the bottom floor or basement.

#### IV. What is in the Atmosphere?

A. Nitrogen – 78% It has no taste, smell, color, flammability, or reactivity with the other elements at earth's temperature.

B. Plants and bacteria require large amounts of nitrogen in the air for survival.

C. Oxygen – 21% Also has not taste, smell, or color. It allows some

compounds to be flammable and is also responsible for rusting of metals.

D. Carbon dioxide – less than 1% and is necessary for photosynthesis and has traveled through the rocks, oceans, and air around earth.

E. Argon, neon, helium – less than 1% and are chemically unreactive and are hard to remove from the atmosphere.

## V. The Atmosphere

A. troposphere – lowest part of the atmosphere, most gases in this region, most all human activity takes place here.

B. Stratosphere – next layer and contains ozone ( $O_3$ ) which protects life from harmful ultraviolet.

- C. Mesosphere and Ionosphere – northern lights are seen here; meteors burn up in the atmosphere here.

## VI. Air Pollution in the Troposphere

- A.  $\text{SO}_2$  – sulfur dioxide – primarily emitted from coal burning plants and other industrial plants.
- B. PM-10 – dust particles (particulate matter) that has a diameter less than 10 micrometers (1 ten thousandth of a meter).
- C. CO – carbon monoxide – emitted by vehicles into the atmosphere and diminishes the blood's ability to carry oxygen.
- D.  $\text{O}_3$  – ozone – although it is good high in the atmosphere, when in the troposphere it is a part of smog.

- E.  $\text{NO}_2$  – nitrogen dioxide – emitted by vehicles, it is a lung and eye irritant and component of haze.
- F. Pb – lead – is emitted from burning leaded gasoline and can be absorbed through the skin or breathed in the air.
- G. Clean Air Act of 1990 – seeks to reduce the amounts of these emissions from factories and vehicles.

## VII. Ozone Depletion

- A. Chlorofluorocarbons – CFCs – react with the ozone to form oxygen and other particles. The ozone is permanently destroyed, and can put a hole in the layer, allowing ultraviolet light to reach the earth's surface.

B. CFCs are heavier than air, but due to particle collisions they can rise high into the stratosphere.

C. Natural sources like volcanoes contribute chlorine to the atmosphere, but not nearly as much as CFCs do.