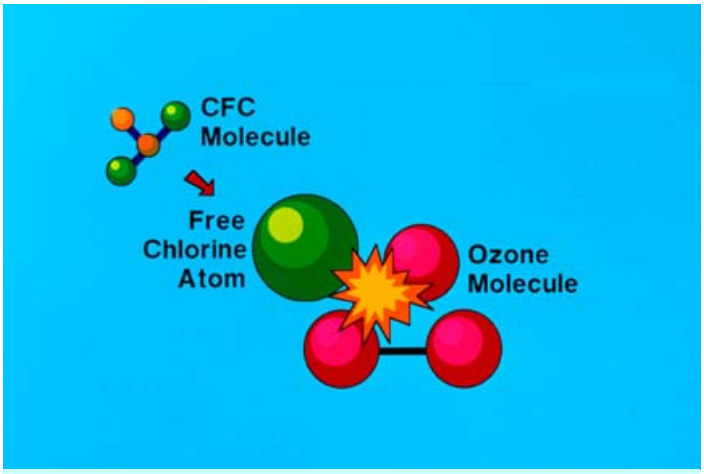
Ideal (and Not So Ideal) Gases

Gases affect life on Earth in many vital ways. Some gases are essential to life on Earth. Others are detrimental to life on Earth. Some impact individual organisms. Others impact entire ecosystems. Still others affect society's infrastructure. For these reasons, many students have been drawn to explore careers that involve the behavior of gases and their impacts on organisms and the environment.



A free chlorine atom from a chlorofluorocarbon (CFC) molecule emitted from aerosol cans and refrigerants destroys ozone molecules in the atmosphere.

Among the key concepts that describe the behavior of gases is the ideal gas law. This law, which is represented by the equation $PV = nRT$, explains the relationships among pressure (P), volume (V), the number of moles in a sample (n), and temperature (T) of a gas. (R represents a constant.) These relationships affect the behavior of gases in the atmosphere. They also affect processes such as photosynthesis and respiration, gas exchange in living cells, and air pollution.

The following areas of study might beckon students to careers involving the behavior of gases.

Air Pollution

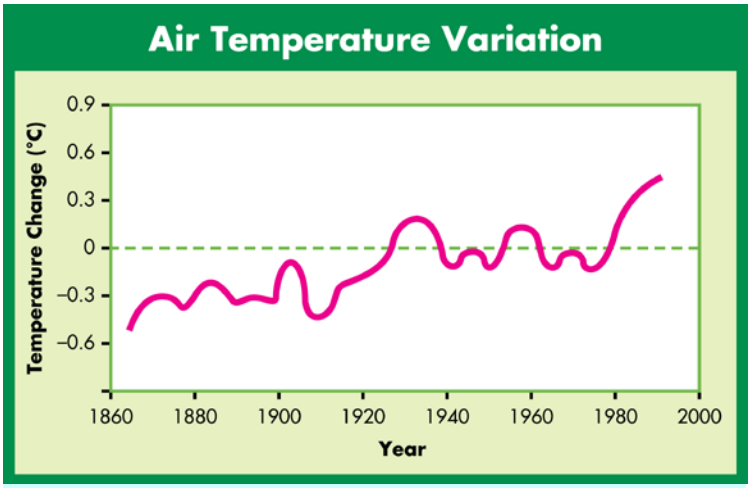
Gases are given off by power plants and factories that burn fossil fuels. These gases can chemically combine with water in the air to produce acid rain. The acid rain harms plants and aquatic organisms. It irritates the lungs of people. It also damages structures made of metal and other materials.

A student interested in investigating the effects of gases produced by the burning of fossil fuels must be educated in biology, inorganic chemistry, and the behavior of gases. Application of the ideal gas law can shed light on how variations in gas concentrations, atmospheric pressure and temperature, and volume all affect the production of acid rain.

Ozone Depletion

High in Earth's atmosphere lies a layer of gas called ozone (O_3). This layer blocks a significant amount of harmful solar radiation and keeps it from reaching the planet's surface. A few decades ago, however, atmospheric chemists discovered that something was destroying the ozone layer. This increased the exposure of living things to harmful radiation.

As it turned out, that "something" was a product of human activity, a gas used in aerosol containers and refrigerants. The gas escaped into the air and reacted with ozone, creating holes in the ozone layer. The scientists working on the problem needed to understand the chemistry of ozone, aerosols, refrigerants, the atmosphere, and the laws that govern their behavior.



The graph shows that global temperatures have been increasing over the past 120 years.

Climate Change

Among the most important issues of our time is the effect of gases emitted by industry and transportation on the world's climate. To study and evaluate these effects, and possibly halt or reverse them, a scientist must understand the chemistry of gases, and the laws that affect their behavior.

Scientists studying climate change must also have knowledge about climatology. This includes understanding the social and economic impacts of both climate change and the control of human-made gaseous emissions.

