



Curriculum Units by Fellows of the Yale-New Haven Teachers Institute
2021 Volume IV: The Earth's Greenhouse and Global Warming

Chemistry of Greenhouse Gases

Guide for Curriculum Unit 21.04.05
by Michael Petrescu

Water vapor, carbon dioxide and some other gases present in the atmosphere in much smaller quantities absorb some of the thermal radiation leaving the surface, acting as a partial blanket for this radiation. This blanketing is known as the natural greenhouse effect and the gases are known as greenhouse gases. It is called 'natural' because almost all the atmospheric gases were there long before human beings came on the scene. The enhanced greenhouse effect, or global warming, is the added effect caused by the gases present in the atmosphere due to human activities such as the burning of fossil fuels and deforestation.

Greenhouse gases emitted by human activities alter Earth's energy balance and therefore, its climate. Humans also affect climate by changing the nature of the land surfaces and through the emission of pollutants that affect the amount and type of particles in the atmosphere.

Scientists have determined that, when all human and natural factors are considered, Earth's climate balance has been altered towards warming, with the biggest contributor being increases in carbon dioxide.

The purpose of this unit is to inform high school students about the three main greenhouse gases (carbon dioxide, methane and nitrous oxide). The unit will be a mix of organic and inorganic chemistry and will describe the physical and chemical properties of the three main gases and the most important chemical reactions that move the greenhouse gases into and out of the atmosphere. One section of the unit will discuss the "global warming potential" (what makes a stronger or a weaker greenhouse gas) and the balance between greenhouse gases.

This unit is intended to be taught in high school Chemistry and Physical Science classes. The unit can be used also by middle school 7th and 8th grade Science teachers to introduce students to concepts related to greenhouse gases and global warming. The unit requires about 12 class periods and will last approximately three weeks.

(Developed for Engineering, grade 8; recommended for Physical Science, Chemistry, and Environmental Science, grade 10)

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