



Greenhouse Gasses

High School Grades

Lesson Summary

Students graph and analyze raw data for concentrations of four different greenhouse gasses in our atmosphere

Prior Knowledge & Skills

- Graphing skills
- Knowledge of the greenhouse effect

AAAS Science Benchmarks

The Nature of Mathematics

Mathematics, Science, and Technology

The Physical Setting

The Earth

The Mathematical World

Symbolic Relationships

Common Themes

Constancy and Change

NSES Science Standards

Science in Personal and Social Perspectives

Natural and Human Induced Hazards

Unifying Concepts and Processes

Change, Constancy, and Measurement

Physical Science

Chemical Reactions

Teaching Time: ~ 1 hour

Materials

- Graph paper
- Pen/pencil or graphing program on a computer

Advanced Planning

Preparation Time: ~10 minutes

1. Review the instructions
2. Gather the necessary supplies.

Recommended Reading: (attached)

Institute for Global Environmental Strategies: Discover Earth Program Materials

<http://www.strategies.org/index.aspx>

Activity 8: Greenhouse Gases

Objective: To graph and analyze raw data for concentrations of four greenhouse gases in our atmosphere.

Materials:

graph paper
pen/pencil
or
graphing program on a computer

Procedure:

1. Plot the data set for each of the greenhouse gases as a function of time versus concentration. Time should be on the horizontal (x) axis. Concentration should be on the vertical (y) axis.
2. Answer the conclusion questions.

Conclusion Questions:

1. In what year did the CFC's reach their maximum concentration? Why do you think that it occurred in this year?
 2. What is the difference in parts per billion by volume (ppbv) between the concentrations of nitrous oxide in the years 1960-1970? For 1980-1990?
 3. What is the slope of the line of carbon dioxide concentrations? What does this slope represent?
 4. What is the difference in concentrations of methane between 1850-1990?
- 8-21
5. Explain the importance of ozone in our atmosphere.
 6. What types of chemicals destroy the ozone layer?
 7. What is the greenhouse effect? How does it work?
 8. Where are the two largest holes located in the ozone layer? What negative effects will this have on Earth's organisms, present day sea level, and weather patterns?
 9. What, in your opinion, do you think will happen to the j factor in the improved energy balance equation? What ultimate effect will this have on the energy balance of the Earth?
- 8-22

Carbon Dioxide Concentrations
Mauna Loa, Hawaii

Year	ppmv	Year	ppmv
1958	314.8	1974	330.4
1959	316.1	1975	331.0
1960	317.0	1976	332.1
1961	317.7	1977	333.6
1962	318.6	1978	335.2
1963	319.1	1979	336.5
1964	319.4	1980	338.4
1965	320.4	1981	339.5
1966	321.1	1982	340.8
1967	322.0	1983	342.8
1968	322.8	1984	344.3
1969	324.2	1985	345.7
1970	325.5	1986	346.9
1971	326.5	1987	348.6
1972	327.6	1988	351.2
1973	329.8		

Methane Gas Concentration

Year	ppm	Year	ppm
1850	0.09	1975	1.45
1879	0.93	1976	1.47
1880	0.90	1977	1.50
1892	0.88	1978	1.52
1908	1.00	1979	1.55
1917	1.00	1980	1.56
1918	1.02	1981	1.58
1927	1.03	1982	1.60
1929	1.13	1983	1.60
1940	1.12	1984	1.61
1949	1.18	1985	1.62
1950	1.20	1986	1.63
1955	1.26	1987	1.65
1956	1.30	1988	1.67
1957	1.34	1989	1.69
1958	1.35	1990	1.72

Chlorofluorocarbon (CFC) Production
in kilotons per year

Year	Amount	Year	Amount
1955	100	1975	350
1957	120	1977	360
1959	140	1979	330
1961	150	1981	325
1963	150	1983	320
1965	200	1985	340
1967	225	1987	300
1969	290	1989	305
1971	320	1991	310
1973	375		

Nitrous Oxide Concentration

Year	ppbv	Year	ppbv
1750	283.0	1880	289.5
1760	283.5	1890	290.0
1770	284.0	1900	291.0
1780	284.5	1910	292.0
1790	285.0	1920	292.5
1800	285.5	1930	293.0
1810	286.0	1940	294.0
1820	286.5	1950	295.0
1830	287.0	1960	297.0
1840	287.5	1970	299.0
1850	288.0	1980	305.0
1860	288.5	1990	310.0
1870	289.0		