CARBON THROUGH THE SEASONS

DESCRIPTION

In this lesson plan, students learn about the carbon cycle and understand how concentrations of carbon dioxide (CO_2) in the Earth's atmosphere vary as the seasons change. Students also learn that even with these seasonal variations, the overall amount of CO_2 is increasing in the atmosphere as a result of people's activities, which are changing the natural carbon cycle.

BACKGROUND

Carbon is a chemical element that is found all over the world and in every living thing. Oxygen is another element that's found in the air we breathe. When carbon and oxygen bond together, they form a colorless, odorless gas called CO_2. In the Earth's atmosphere, CO_2 is a greenhouse gas, which means it traps heat. This "greenhouse effect" naturally helps to keep the Earth's temperature at a level that can support life on the planet.

The atmosphere isn't the only part of the Earth that has carbon. The oceans store large amounts of carbon, and so do plants, soil, and deposits of coal, oil, and natural gas deep underground. Carbon constantly moves from one part of the Earth to another through a natural repeating pattern called the carbon cycle. The carbon cycle helps to maintain a balanced level of CO_2 in the Earth's atmosphere.

But right now, people are changing this natural balance by adding more CO_2 to the atmosphere whenever we burn fossil fuels (such as coal, oil, and natural gas)—whether it's to drive our cars, use electricity, or make products. This extra CO_2 is being added to the atmosphere faster than natural processes can remove it, causing the atmosphere to trap more heat and causing the Earth's average temperature to rise. Scientists have found that the recent levels of CO_2 in the atmosphere are abnormally high compared with the long-term historical trend, and these levels are continuing to increase at an unprecedented rate.

The amount of CO_2 found in the atmosphere varies over the course of a year. Much of this variation happens because of the role of plants in the carbon cycle. Plants use CO_2 from the atmosphere, along with sunlight and water, to make food and other substances that they need to grow. They release oxygen into the air as a byproduct. This process is called photosynthesis. Another process that is part of the carbon cycle is respiration, by which plants and animals take up oxygen and release CO_2 back into the atmosphere.

When plants are growing, photosynthesis outweighs respiration. As a result, plants take more CO_2 out of the atmosphere during the warm months when they are growing the most. This can lead to noticeably lower CO_2 concentrations in the atmosphere. Respiration occurs all the time, but dominates during the colder months of the year, resulting in higher CO_2 levels in the atmosphere during those months.

TIME:

Introduction: 60–90 minutes

LEARNING OBJECTIVES:

Students will:

- Learn about the carbon cycle
- Understand how seasonal variations affect global atmospheric CO_2 concentrations
- Understand how CO_2 concentrations in the atmosphere are changing overall in recent decades

NATIONAL SCIENCE STANDARDS:

- Content Standard A: Science as inquiry
- Content Standard D: Earth and space science
- Content Standard E: Science and technology

ADAPTED FROM:

National Oceanic and Atmospheric Administration (NOAA): http://www.esrl.noaa.gov/gsd/outreach/education/poet/CO2-Seasons.pdf.

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CARBON THROUGH THE SEASONS

Carbon Sources and Sinks

A *carbon source* is any process or activity that releases carbon into the atmosphere. Both natural processes and people's activities can be carbon sources. A *carbon sink* takes up or stores carbon on the Earth.

The Northern and Southern Hemispheres have opposite seasons. If both hemispheres had roughly the same amount of plant life, we might expect their seasonal effects on the carbon cycle to cancel each other out. However, if you look at a map, you'll see that the Northern Hemisphere has more land than the Southern Hemisphere and a lot more plant life (especially considering that Antarctica has almost none). As a result, global CO_2 concentrations show seasonal differences that are most heavily influenced by the growing season in the Northern Hemisphere.

Scientists monitor the amount of CO_2 and other gases in the atmosphere at stations such as the Mauna Loa Observatory in Hawaii. The Mauna Loa Observatory is one of the sites that have helped scientists determine that CO_2 levels in the atmosphere have increased significantly in recent decades and that these levels are continuing to rise at a rapid rate. CO_2 stays in the atmosphere for long enough that it is able to spread fairly evenly around the world, so even measurements from a single site (like Mauna Loa) can be representative of global average CO_2 concentrations.

GROUPS

Students should work in teams (group size of five is optimal). Each group should be assigned one set of years of "Mauna Loa Observatory Data" (see worksheets; each group will receive 10 to 12 years of data), and each student should receive one copy of his/her group's assigned data.

MATERIALS

- "Mauna Loa Observatory Data:" assign one time period per group, and give a copy of the data for the selected time period to each student in the group.
- A copy of the "Mauna Loa Worksheet" for each group
- A copy of the "Mauna Loa Monthly Average CO_2 Concentrations, 1958 to 2011" graph for each group
- Calculators
- Graph paper for each group
- Colored pencils

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VOCABULARY

Carbon:
A chemical element that is essential to all living things. Carbon combines with other elements to form a variety of different compounds. Plants and animals are made up of carbon compounds, and so are certain minerals. Carbon combines with oxygen to make a gas called carbon dioxide (CO_2).

Carbon cycle:
The movement and exchange of carbon through living organisms, the ocean, the atmosphere, rocks and minerals, and other parts of the Earth. Carbon moves from one place to another through various chemical, physical, geological, and biological processes.

Carbon dioxide:
A colorless, odorless greenhouse gas. It is produced naturally when dead animals or plants decay, and it is used by plants during photosynthesis. People are adding carbon dioxide into the atmosphere, mostly by burning fossil fuels such as coal, oil, and natural gas. This extra carbon dioxide is the main cause of climate change.

Greenhouse gas:
Also sometimes known as "heat-trapping gases," greenhouse gases are natural or manmade gases that trap heat in the atmosphere and contribute to the greenhouse effect. Greenhouse gases include water vapor, carbon dioxide, methane, nitrous oxide, and fluorinated gases.

Parts per million (ppm):
A unit of measurement that can be used to describe the concentration of a particular substance within air, water, soil, or some other medium. For example, the concentration of carbon dioxide in the Earth's atmosphere is almost 400 parts per million, which means 1 million liters of air would contain about 400 liters of carbon dioxide.

Photosynthesis:
The process by which green plants use sunlight, water, and carbon dioxide to make food and other substances that they use to grow. In the process, plants release oxygen into the air.

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Mauna Loa on the World Map

Scientists monitor the amount of CO_2 and other gases in the atmosphere at stations such as the Mauna Loa Observatory in Hawaii. The Mauna Loa Observatory is one of the sites that have helped scientists determine that CO_2 levels in the atmosphere have increased significantly in recent decades and that these levels are continuing to rise at a rapid rate.

Image source: Carbon Dioxide Information Analysis Center: http://cdiac.ornl.gov/.

INSTRUCTIONS

Part 1: Plotting Monthly Atmospheric CO_2 Data

1. Tell the students that they will be learning about the carbon cycle by looking at monthly atmospheric CO_2 concentration data from 1959 to 2011. Explain that these data come from the Mauna Loa Observatory in Hawaii, and show students where the observatory is located on a map. Explain that because CO_2 spreads throughout the world's atmosphere, measurements from Mauna Loa are actually representative of global average CO_2 levels.

2. Show the class a short video about the carbon cycle and how people are changing this natural cycle at "Learn the Basics: Today's Climate Change" on EPA's *A Student's Guide to Global Climate Change* website (http://www.epa.gov/climatechange/students/basics/today/carbon-dioxide.html). You can also show a diagram of the carbon cycle (see box below), or demonstrate how the carbon cycle works by drawing it on the chalkboard.

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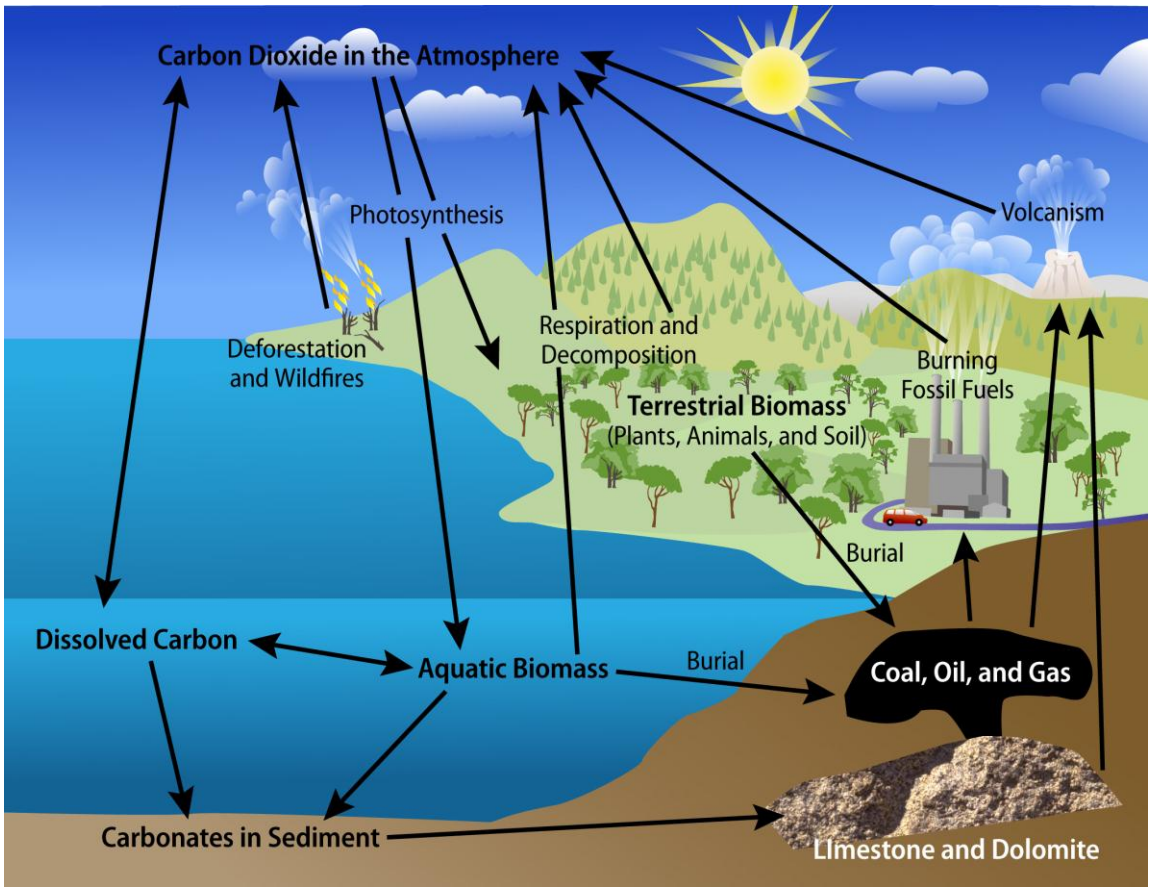
The Carbon Cycle



Adapted from: CO_2logic: http://www.co2logic.com/home.aspx/html/Images/carbon%20cycle.jpg.

3. Discuss the processes of respiration and photosynthesis in plants and how these processes influence the amount of CO_2 in the atmosphere during the course of a year.

4. Break the students into groups of approximately five. Assign each group a set of data from the "Mauna Loa Observatory Data" tables (each group will get 10 to 12 years of data), and pass out one copy of the assigned data per student. Also provide each group with a sheet of graph paper and a copy of the "Mauna Loa Worksheet."

5. Discuss what parts per million (ppm) means.
[Answer: Parts per million or ppm is a unit of measurement that can be used to describe the concentration of a particular substance within air, water, soil, or some other medium. For example, the concentration of carbon dioxide in the Earth's atmosphere is almost 400 parts per million, which means 1 million liters of air would contain about 400 liters of carbon dioxide.]

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6. Tell students that each group will be graphing their data on the graph paper. Explain that students in each group should work as a team by taking turns to plot data points on the same graph paper. Ask students to follow the "Instructions for Plotting the Graph" on the "Mauna Loa Data Worksheet" to plot their data.

7. When students have finished plotting their graphs, hand out a copy of the "Mauna Loa Monthly Average CO_2 Concentration, 1958 to 2011" graph to each group. Tell students that this is how the entire Mauna Loa Observatory data series looks when it is plotted in one graph.

8. Discuss the following questions in class:

   - What patterns do you notice in your graph? (Ask students to keep these patterns in mind as you ask them additional questions.)
     [Answer: An increase in CO_2, followed by a decrease in CO_2, creating a repeating pattern of peaks and troughs much like a wave. Another pattern is an increase in heights of both peaks and troughs over time.]

   - What does the increase in the height of the peaks and troughs mean?
     [Answer: The overall amount of CO_2 in the atmosphere is increasing.]

   - According to your data, during what month and during what season are the CO_2 concentrations highest? Lowest?
     [Answer: highest concentrations in April and May (spring), lowest in August and September (early fall)]

   - Explain how the seasonal changes of CO_2 concentration in the atmosphere and the growing season for plants and are related?
     [Answer: CO_2 in the atmosphere decreases during the growing season and increases during the rest of the year, which leads to maximum buildup in April and May before photosynthesis begins to take over again. Photosynthesis, in which plants take up CO_2 from the atmosphere and release oxygen, dominates during the growing season (the warmer part of the year). Respiration, by which plants and animals take up oxygen and release CO_2, occurs all the time but dominates during the colder months of the year.]

   - Are the seasons the same in the Northern and Southern Hemispheres?
     [Answer: No, the seasons in the Northern and Southern Hemispheres are opposite.]

   - How does this difference affect CO_2 concentrations in the atmosphere?
     [Answer: While CO_2 concentrations in the atmosphere are increasing in the Northern Hemisphere, CO_2 concentrations are decreasing in the Southern Hemisphere, and vice versa.]

   - There is more land in the Northern Hemisphere than in the Southern Hemisphere. How might this difference affect CO_2 concentrations in the atmosphere?
     [Answer: The carbon cycle is more pronounced in the Northern Hemisphere (which has relatively more land mass and terrestrial vegetation) than in the Southern Hemisphere (which is more dominated by oceans).]

   - Earlier, you noticed that your line graph has a repeating pattern. Explain.
     [Answer: The variations within each year are the result of the annual cycles of photosynthesis and respiration.]

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Part 2: Calculating Annual Average CO_2 Concentrations

[This portion of the lesson can be done in another class period or assigned as homework. It can be done as a group or individual exercise.]

1. Have each group of students complete the "Annual Average CO_2 Concentrations" chart on the "Mauna Loa Data Worksheet" for their set of data. Discuss the following questions**:**

   - Is there a particular pattern in the change in annual average CO_2 concentration for your set of years? *[Answer: Yes, CO_2 concentration increases every year. (Each group's dataset shows this same pattern.)]*

   - Ask the students what this pattern means. *[Answer: It means more CO_2 was added to the atmosphere.]*

2. Tell students that people are changing this Earth's natural carbon balance by adding more CO_2 to the atmosphere when we burn fossil fuels (such as coal, oil, and natural gas)—whether it's to drive our cars, power our homes, or make products. This extra CO_2 is being added to the atmosphere faster than natural processes can remove it, causing the atmosphere to trap more heat and causing the Earth's average temperature to rise.

EXTENSION

There are many monitoring stations like Mauna Loa Observatory that collect data about atmospheric CO_2 levels. Some scientists even use ice cores and tree rings to learn about the amount of CO_2 in the atmosphere hundreds of thousands of years ago.

- Tell students that the CO_2 levels in the past hundred years are abnormally high compared with natural historical levels, and that these levels are continuing to increase at an unprecedented rate.
- Explain that scientists can compare the amount of CO_2 in the atmosphere with the amount trapped in ancient ice cores, which show that the atmosphere had less CO_2 in the past.
- Show this three-minute YouTube video about the history of global atmospheric CO_2. (http://www.youtube.com/watch?feature=player_embedded&v=bbgUE04Y-Xg).The video starts with an animated graph of seasonal CO_2 variations observed at stations around the world from 1979 to 2011, then looks at patterns back to 800,000 years ago.

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MAUNA LOA OBSERVATORY DATA

Mauna Loa CO_2 Monthly Average Concentrations, 1959 to 1969 (ppm)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1959	315.62	316.38	316.71	317.72	318.29	318.15	316.54	314.80	313.84	313.26	314.80	315.58
1960	316.43	316.97	317.58	319.02	320.03	319.59	318.18	315.91	314.16	313.83	315.00	316.19
1961	316.93	317.70	318.54	319.48	320.58	319.77	318.57	316.79	314.80	315.38	316.10	317.01
1962	317.94	318.56	319.68	320.63	321.01	320.55	319.58	317.40	316.26	315.42	316.69	317.69
1963	318.74	319.08	319.86	321.39	322.25	321.47	319.74	317.77	316.21	315.99	317.12	318.31
1964	319.57	320.07	320.73	321.77	322.25	321.89	320.44	318.70	316.70	316.79	317.79	318.71
1965	319.44	320.44	320.89	322.13	322.16	321.87	321.39	318.81	317.81	317.30	318.87	319.42
1966	320.62	321.59	322.39	323.87	324.01	323.75	322.39	320.37	318.64	318.10	319.79	321.08
1967	322.07	322.50	323.04	324.42	325.00	324.09	322.55	320.92	319.31	319.31	320.72	321.96
1968	322.57	323.15	323.89	325.02	325.57	325.36	324.14	322.03	320.41	320.25	321.31	322.84
1969	324.00	324.42	325.64	326.66	327.34	326.76	325.88	323.67	322.38	321.78	322.85	324.11

Data source: National Oceanic and Atmospheric Administration (NOAA): http://www.esrl.noaa.gov/gmd/ccgg/trends/mlo.html. Accessed August 2012.

Mauna Loa CO_2 Monthly Average Concentrations, 1970 to 1979 (ppm)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1970	325.03	325.99	326.87	328.13	328.07	327.66	326.35	324.69	323.10	323.16	323.98	325.13
1971	326.17	326.68	327.18	327.78	328.92	328.57	327.34	325.46	323.36	323.57	324.80	326.01
1972	326.77	327.63	327.75	329.72	330.07	329.09	328.05	326.32	324.93	325.06	326.50	327.55
1973	328.54	329.56	330.30	331.50	332.48	332.07	330.87	329.31	327.51	327.18	328.16	328.64
1974	329.35	330.71	331.48	332.65	333.19	332.12	330.99	329.17	327.41	327.21	328.34	329.50
1975	330.68	331.41	331.85	333.29	333.91	333.40	331.74	329.88	328.57	328.36	329.33	330.59
1976	331.66	332.75	333.46	334.78	334.78	334.06	332.95	330.64	328.96	328.77	330.18	331.65
1977	332.69	333.23	334.97	336.03	336.82	336.10	334.79	332.53	331.19	331.21	332.35	333.47
1978	335.10	335.26	336.61	337.77	338.01	337.98	336.48	334.37	332.33	332.41	333.76	334.83
1979	336.21	336.65	338.13	338.94	339.00	339.20	337.60	335.56	333.93	334.12	335.26	336.78

Data source: National Oceanic and Atmospheric Administration (NOAA): http://www.esrl.noaa.gov/gmd/ccgg/trends/mlo.html. Accessed August 2012.

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MAUNA LOA OBSERVATORY DATA

Mauna Loa CO_2 Monthly Average Concentrations, 1980 to 1989 (ppm)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1980	337.80	338.28	340.04	340.86	341.47	341.26	339.34	337.45	336.10	336.05	337.21	338.29
1981	339.36	340.51	341.57	342.56	343.01	342.49	340.68	338.49	336.92	337.12	338.59	339.90
1982	340.92	341.69	342.85	343.92	344.67	343.78	342.23	340.11	338.32	338.39	339.48	340.88
1983	341.64	342.87	343.59	345.25	345.96	345.52	344.15	342.25	340.17	340.30	341.53	343.07
1984	344.05	344.77	345.46	346.77	347.55	346.98	345.55	343.20	341.35	341.68	343.06	344.54
1985	345.25	346.06	347.66	348.20	348.92	348.40	346.66	344.85	343.20	343.08	344.40	345.82
1986	346.54	347.13	348.05	349.77	350.53	349.90	348.11	346.09	345.01	344.47	345.86	347.15
1987	348.38	348.70	349.72	351.32	352.14	351.61	349.91	347.84	346.52	346.65	347.95	349.18
1988	350.38	351.68	352.24	353.66	354.18	353.68	352.58	350.66	349.03	349.08	350.15	351.44
1989	352.89	353.24	353.80	355.59	355.89	355.30	353.98	351.53	350.02	350.29	351.44	352.84

Data source: National Oceanic and Atmospheric Administration (NOAA): http://www.esrl.noaa.gov/gmd/ccgg/trends/mlo.html. Accessed August 2012.

Mauna Loa CO_2 Monthly Average Concentrations, 1990 to 1999 (ppm)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1990	353.79	354.88	355.65	356.27	357.29	356.32	354.89	352.89	351.28	351.59	353.05	354.27
1991	354.87	355.68	357.06	358.51	359.09	358.10	356.12	353.89	352.30	352.32	353.79	355.07
1992	356.17	356.93	357.82	359.00	359.55	359.32	356.85	354.91	352.93	353.31	354.27	355.53
1993	356.86	357.27	358.36	359.27	360.19	359.52	357.42	355.46	354.10	354.12	355.40	356.84
1994	358.22	358.98	359.91	361.32	361.68	360.80	359.39	357.42	355.63	356.09	357.56	358.87
1995	359.87	360.79	361.77	363.23	363.77	363.22	361.70	359.11	358.11	357.97	359.40	360.61
1996	362.04	363.17	364.17	364.51	365.16	364.93	363.53	361.38	359.60	359.54	360.84	362.18
1997	363.04	364.09	364.47	366.25	366.69	365.59	364.34	362.20	360.31	360.71	362.44	364.33
1998	365.18	365.98	367.13	368.61	369.49	368.95	367.74	365.79	364.01	364.35	365.52	367.08
1999	368.12	368.98	369.60	370.96	370.77	370.33	369.28	366.86	364.94	365.35	366.68	368.04

Data source: National Oceanic and Atmospheric Administration (NOAA): http://www.esrl.noaa.gov/gmd/ccgg/trends/mlo.html. Accessed August 2012.

CARBON THROUGH THE SEASONS

MAUNA LOA OBSERVATORY DATA

Mauna Loa CO_2 Monthly Average Concentrations, 2000 to 2011 (ppm)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2000	369.25	369.50	370.56	371.82	371.51	371.71	369.85	368.20	366.91	366.99	368.33	369.67
2001	370.52	371.49	372.53	373.37	373.82	373.18	371.57	369.63	368.16	368.42	369.69	371.18
2002	372.45	373.14	373.93	375.00	375.65	375.50	374.00	371.83	370.66	370.51	372.20	373.71
2003	374.87	375.62	376.48	377.74	378.50	378.18	376.72	374.31	373.20	373.10	374.64	375.93
2004	377.00	377.87	378.73	380.41	380.63	379.56	377.61	376.15	374.11	374.44	375.93	377.45
2005	378.47	379.76	381.14	382.20	382.47	382.20	380.78	378.73	376.66	376.98	378.29	379.92
2006	381.35	382.16	382.66	384.73	384.98	384.09	382.38	380.45	378.92	379.16	380.18	381.79
2007	382.93	383.81	384.56	386.40	386.58	386.05	384.49	382.00	380.90	381.14	382.42	383.89
2008	385.44	385.73	385.97	387.16	388.50	387.88	386.42	384.15	383.09	382.99	384.13	385.56
2009	386.93	387.42	388.77	389.46	390.19	389.44	387.91	385.92	384.79	384.39	386.00	387.27
2010	388.45	389.82	391.08	392.46	392.95	392.03	390.13	388.15	386.80	387.18	388.59	389.68
2011	391.19	391.76	392.40	393.28	394.16	393.68	392.39	390.08	389.00	388.92	390.20	391.80

Data source: National Oceanic and Atmospheric Administration (NOAA): http://www.esrl.noaa.gov/gmd/ccgg/trends/mlo.html. Accessed August 2012.

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MAUNA LOA DATA WORKSHEET

NAME: _____ **DATE:** _____

Instructions for Plotting the Graph

1. On the graph paper, label the x-axis as "Year and Month." Begin numbering from left to right on the x-axis from 1 to 12 at intervals of 1. Each point represents a month of the year: 1 is January, 2 is February, and so on. Label this first group of 12 points (or months) below the x-axis as the first year of your assigned data. Continue numbering points on the x-axis in sets of 12 months for the next years.
2. On the y-axis (on the left-hand side of the paper), number the parts per million for CO_2 concentrations. Begin with 300 at the lower end, and number up to 400 ppm, counting by intervals of 10. Label the axis.
3. Using information from the "Mauna Loa Observatory Data," table, plot the points corresponding to each monthly average atmospheric CO_2 concentration for the years assigned to your group.

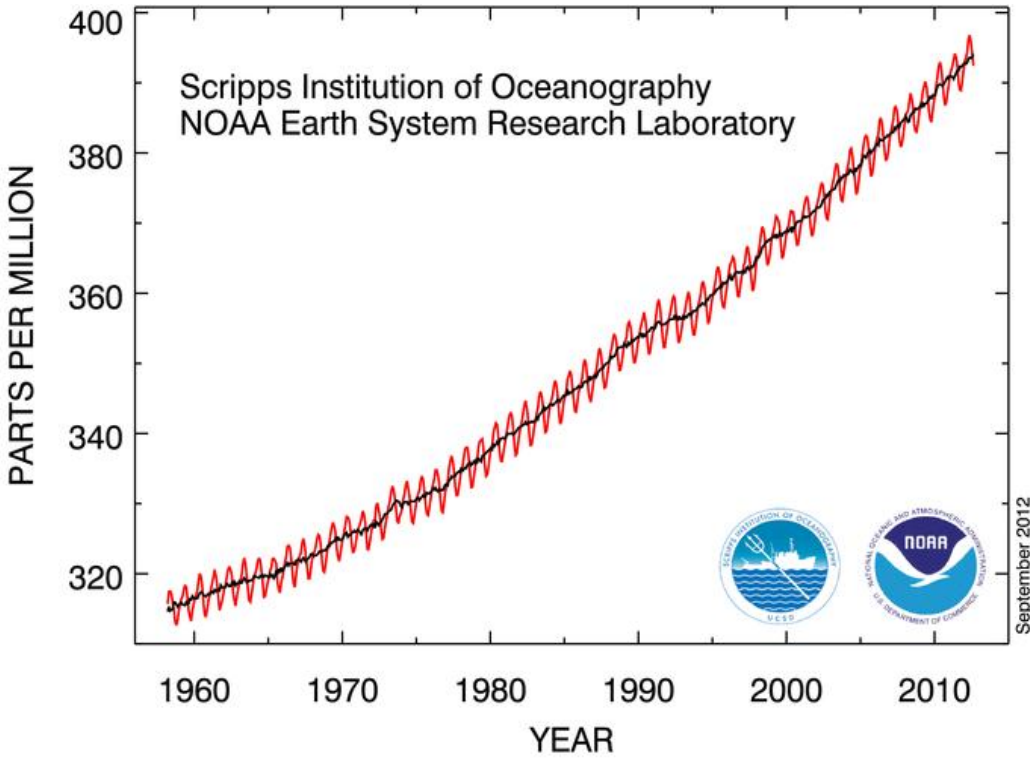
Instructions for Filling Out the Changes in Annual Average CO_2 Concentrations

Fill in the years of your individual dataset in the chart below. Calculate 1) the average (mean) CO_2 concentration (ppm) for each of the years in your dataset, 2) the amount of change (ppm) from the previous year, and 3) the direction of change (whether it has increased, decreased, or remained unchanged).

Annual Average CO_2 Concentrations

Year	Annual average	Difference from previous year	Direction

Mauna Loa Monthly Average CO_2 Concentration, 1958 to 2011



The Mauna Loa Observatory is one of the sites that have helped scientists determine that CO_2 levels in the atmosphere have increased significantly in recent decades and that these levels are continuing to rise at a rapid rate. CO_2 stays in the atmosphere for long enough that it is able to spread fairly evenly around the world, so even measurements from a single site (like Mauna Loa) can be representative of global average CO_2 concentrations.

Image source: National Oceanic and Atmospheric Administration (NOAA): http://www.esrl.noaa.gov/gmd/webdata/ccgg/trends/co2_data_mlo.png. Accessed September 2012.

For the latest version, please see the graph in the "Full Mauna Loa CO_2 Record" section of NOAA's page at http://www.esrl.noaa.gov/gmd/ccgg/trends/mlo.html.

ANNUAL AVERAGE CO_2 CONCENTRATIONS—ANSWER KEY

Year	Annual average	Difference from previous year	Direction
1959	315.97		
1960	316.91	0.93	Increase
1961	317.64	0.73	Increase
1962	318.45	0.81	Increase
1963	318.99	0.54	Increase
1964	319.62	0.62	Increase
1965	320.04	0.43	Increase
1966	321.38	1.34	Increase
1967	322.16	0.77	Increase
1968	323.05	0.89	Increase
1969	324.62	1.58	Increase
1970	325.68	1.06	Increase
1971	326.32	0.64	Increase
1972	327.45	1.13	Increase
1973	329.68	2.22	Increase
1974	330.18	0.50	Increase
1975	331.08	0.91	Increase
1976	332.05	0.97	Increase
1977	333.78	1.73	Increase
1978	335.41	1.63	Increase
1979	336.78	1.37	Increase
1980	338.68	1.90	Increase
1981	340.10	1.42	Increase
1982	341.44	1.34	Increase
1983	343.03	1.59	Increase
1984	344.58	1.55	Increase
1985	346.04	1.46	Increase
1986	347.38	1.34	Increase
1987	349.16	1.78	Increase
1988	351.56	2.40	Increase
1989	353.07	1.50	Increase
1990	354.35	1.28	Increase

(CONTINUED)

ANNUAL AVERAGE CO_2 CONCENTRATIONS—ANSWER KEY (CONTINUED)

Year	Annual average	Difference from previous year	Direction
1991	355.57	1.22	Increase
1992	356.38	0.82	Increase
1993	357.07	0.69	Increase
1994	358.82	1.76	Increase
1995	360.80	1.97	Increase
1996	362.59	1.79	Increase
1997	363.71	1.12	Increase
1998	366.65	2.95	Increase
1999	368.33	1.67	Increase
2000	369.53	1.20	Increase
2001	371.13	1.61	Increase
2002	373.22	2.08	Increase
2003	375.77	2.56	Increase
2004	377.49	1.72	Increase
2005	379.80	2.31	Increase
2006	381.90	2.10	Increase
2007	383.76	1.86	Increase
2008	385.59	1.82	Increase
2009	387.37	1.79	Increase
2010	389.78	2.40	Increase
2011	391.57	1.79	Increase