

## MiSP Ecology/Pollution — Global Warming Worksheet #2, L2

Name \_\_\_\_\_

Date \_\_\_\_\_

### Is There a Connection between Global Warming And Carbon Dioxide

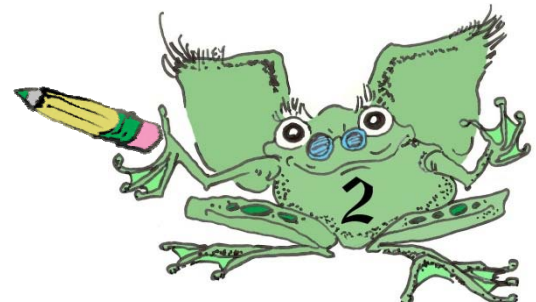
#### Introduction:

Greenhouse gases trap heat in our atmosphere. One of the greenhouse gases is carbon dioxide (CO<sub>2</sub>). Carbon dioxide is a natural part of the atmosphere. It is produced by animals and plants when they break down food for energy and is used by plants when they make food. It is also added when we burn carbon-containing materials like wood, alcohol, and fossil fuels (coal, oil, and natural gas). Many people believe that increased amounts of CO<sub>2</sub> being added to the atmosphere due to the burning of fossil fuels are causing global warming.

In this exercise, we will look at temperature and carbon dioxide data from 1960 to 2005.

The most complete and accurate set of data on atmospheric CO<sub>2</sub> concentrations comes from the Mauna Loa Observatory on the island of Hawaii. Every hour for nearly half a century, scientists have collected air samples from above a barren lava field on the slopes of Earth's largest volcano. The remote location of this site minimizes local disturbances to measurements due to the activity of humans, other animals, and plants.

The temperature data comes from NASA and uses numbers from monitoring stations around the world.



## Procedures:

- Use data from the charts and the graph below to show the changing CO<sub>2</sub> concentration and global average temperature over time.

## Graph the data:

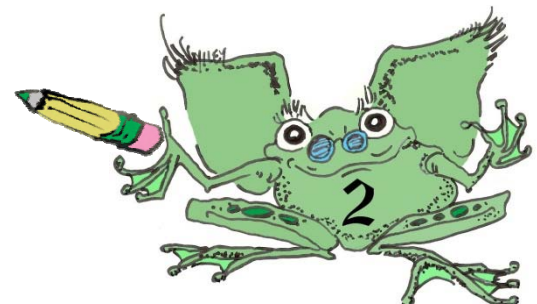
### Temperature graph

- Label the  $x$ -axis.
- Label the  $y$ -axis.
- Connect the data points.
- Draw a best-fit line of the data.

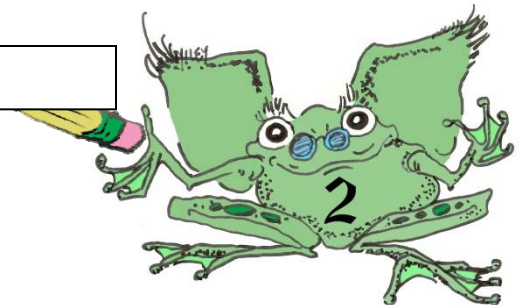
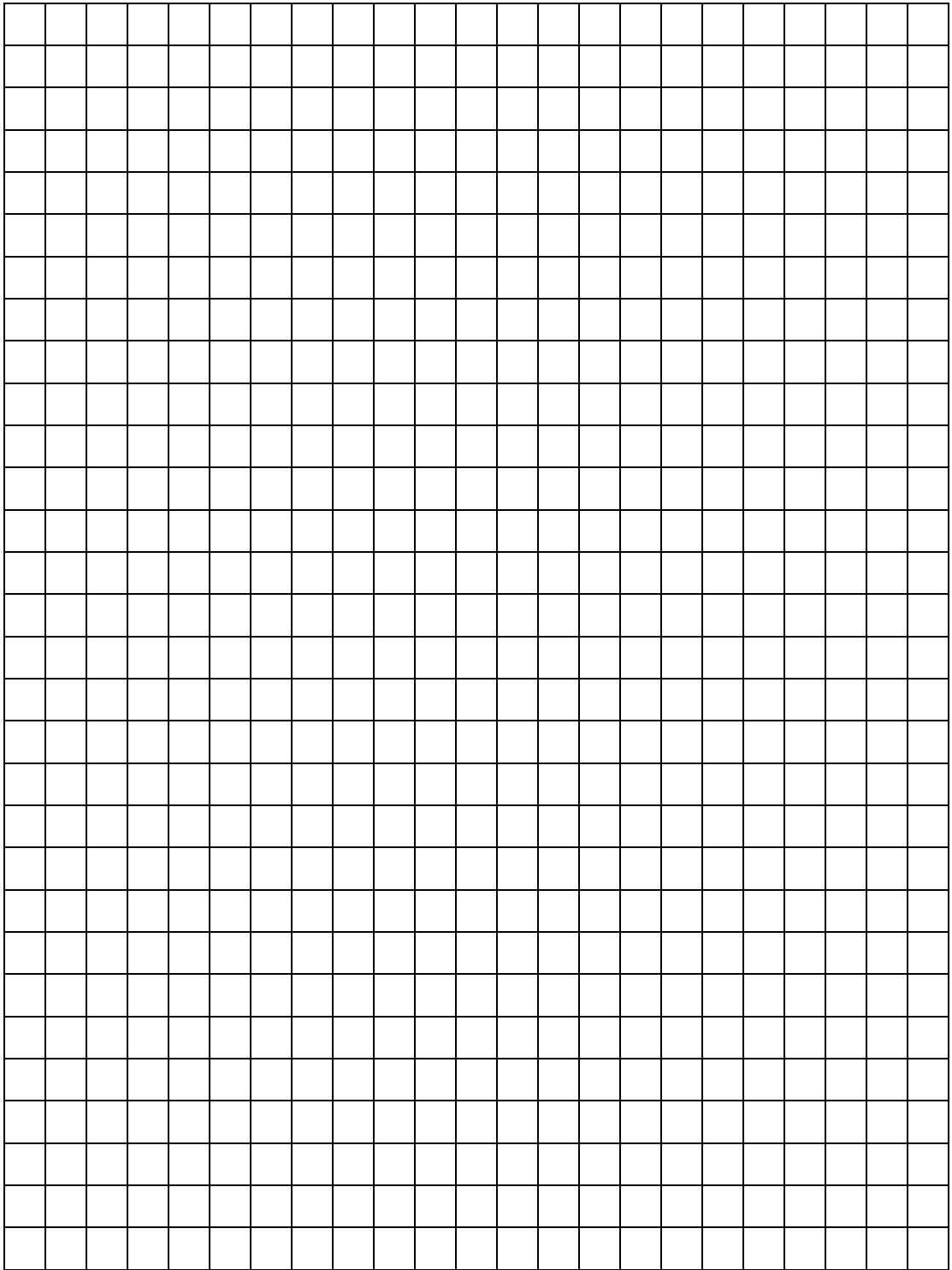
### Carbon dioxide graph

- Label the  $x$ -axis.
- Label the  $y$ -axis.
- Connect the data points.
- Draw a best-fit line of the data.

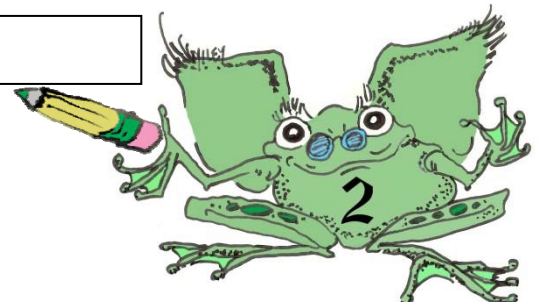
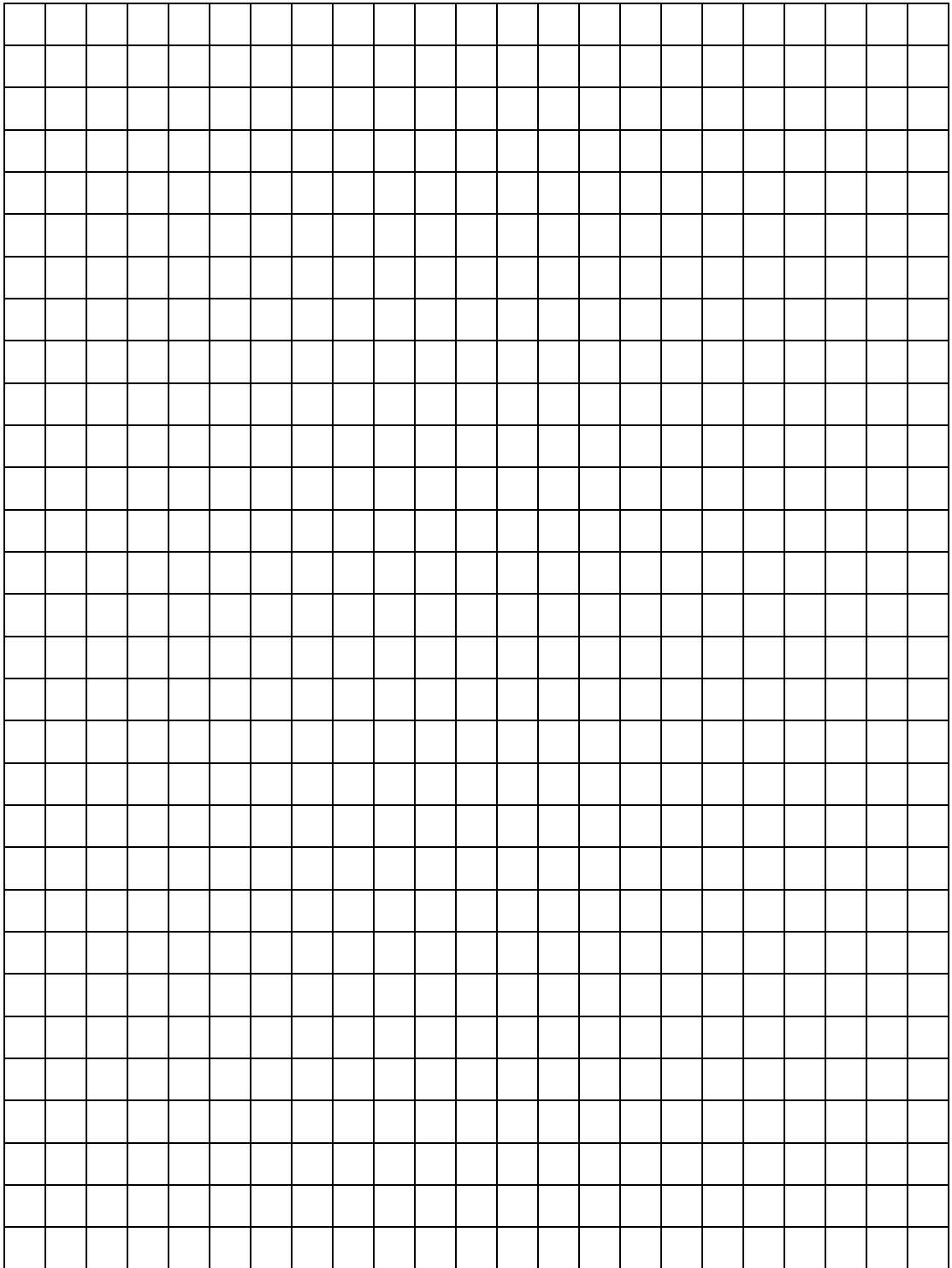
Year	Global Temperature (°C)	CO <sub>2</sub> Concentration (ppm)
1960	14.06	317
1965	13.91	320
1970	13.96	326
1975	14.00	331
1980	14.18	339
1985	14.22	346
1990	14.34	354
1995	14.33	361
2000	14.55	369
2005	14.68	380



Global Temperature from Meteorological  
Stations 1960-2005 (5 year running means)



Carbon Dioxide Concentrations from Mauna  
Loa Observatory, Hawaii, 1960-2005



**Discussion Questions:**

1. From 1960 to 2005, what has happened to:

a. The average world temperature? \_\_\_\_\_  
\_\_\_\_\_

b. Carbon dioxide concentration in the air? \_\_\_\_\_  
\_\_\_\_\_

2. The temperature data goes up and down from data point to data point. Does that mean that people cannot use the data to make predictions? Explain your answer.

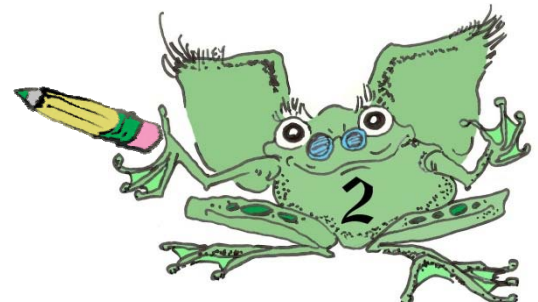
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

3. Discuss how the two graphs compare. How are they similar? How are they different?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

4. The two graphs DO NOT prove that changes in the carbon dioxide concentration in the air have caused global warming. Do the data tell us that changes in carbon dioxide are NOT the cause of global warming?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



5. Scientists know that carbon dioxide is a greenhouse gas and therefore it traps heat in the atmosphere. So, why do people look at data like the two graphs that you made and propose that humans should reduce the amount of carbon dioxide they put in the air and do things to reduce the concentration of atmospheric CO<sub>2</sub>?

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6. Using the best-fit lines on each of the two graphs, predict (extrapolate) the:

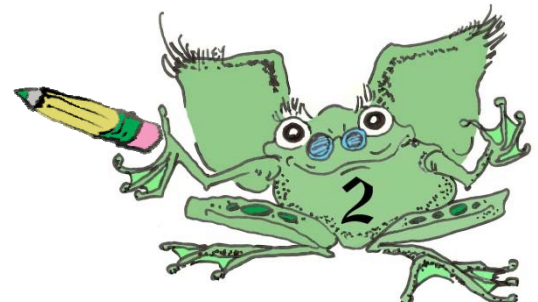
a. average world temperature in 2015 \_\_\_\_\_

b. concentration of carbon dioxide in 2015 \_\_\_\_\_

7. Are the numbers you predicted in 6 greater or less than the temperature and carbon dioxide concentration data in 2005?

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8. People can use unit rate of change (slope) to measure how fast a measurement such as carbon dioxide concentration or temperature is changing. Calculate the unit rate of change for the best-fit line on each graph. (*When you use a best-fit line, the ordered pairs to determine slope must be from the best-fit line, not from your data chart.*)

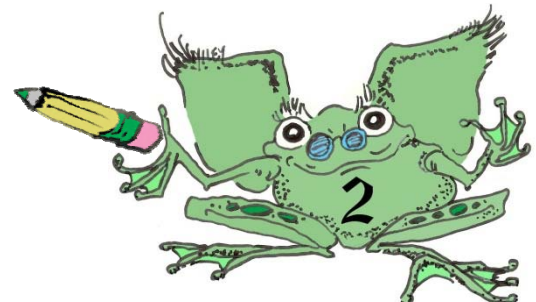
**Unit Rate of Change — average world temperature** =  $\frac{\Delta \text{temperature } (^{\circ}\text{C})}{\Delta \text{time (years)}} = \frac{(y_2 - y_1)}{(x_2 - x_1)}$

Ordered Pair used for calculation ( $x_1, y_1$ ) ( $x_2, y_2$ )	$\Delta$ temperature ( $^{\circ}\text{C}$ ) $\Delta y$	$\Delta$ Time (years) $\Delta x$	<b>Unit Rate of Change (slope)</b> $\Delta y / \Delta x$

**Unit Rate of Change in Carbon Dioxide Concentration =**

$\frac{\Delta \text{carbon dioxide (ppm)}}{\Delta \text{time (years)}} = \frac{(y_2 - y_1)}{(x_2 - x_1)}$

Ordered Pair used for calculation ( $x_1, y_1$ ) ( $x_2, y_2$ )	$\Delta$ carbon dioxide (ppm) $\Delta y$	$\Delta$ Time (years) $\Delta x$	<b>Unit Rate of Change (slope)</b> $\Delta y / \Delta x$



9. Is the sign of these unit rates of change (slope) negative (-) or positive (+)? What does that mean about the changes in carbon dioxide concentration and temperature over time?

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10. Use the unit rate of change (slope) of each graph's best-fit line (calculated in 5a) to determine how much carbon dioxide concentration and average world temperature will change in 10 and 50 years.

	<u>10 years</u>	<u>50 years</u>
average world temperature (°C)	_____	_____
carbon dioxide concentration (ppm)	_____	_____

