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Greenhouse Gas

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TI Graphing Calculator Lesson Plan
Analysis and Interpretation of Greenhouse Gas Data

Name: Janet Siegel

Grade level/Subject: Environmental Science (9/10)

Objectives:

- To learn the use of the TI -84 graphing calculator.
- To plot CO_2 data to more easily see trends in the data and make predictions about what might possibly occur should current trends persist over time.
- To compare the levels of 4 different "greenhouse gases" over a period of approximately 30 years.
- To look at the impact that legislation banning the use of CFC's has had on atmospheric levels of these ozone-damaging chemicals.

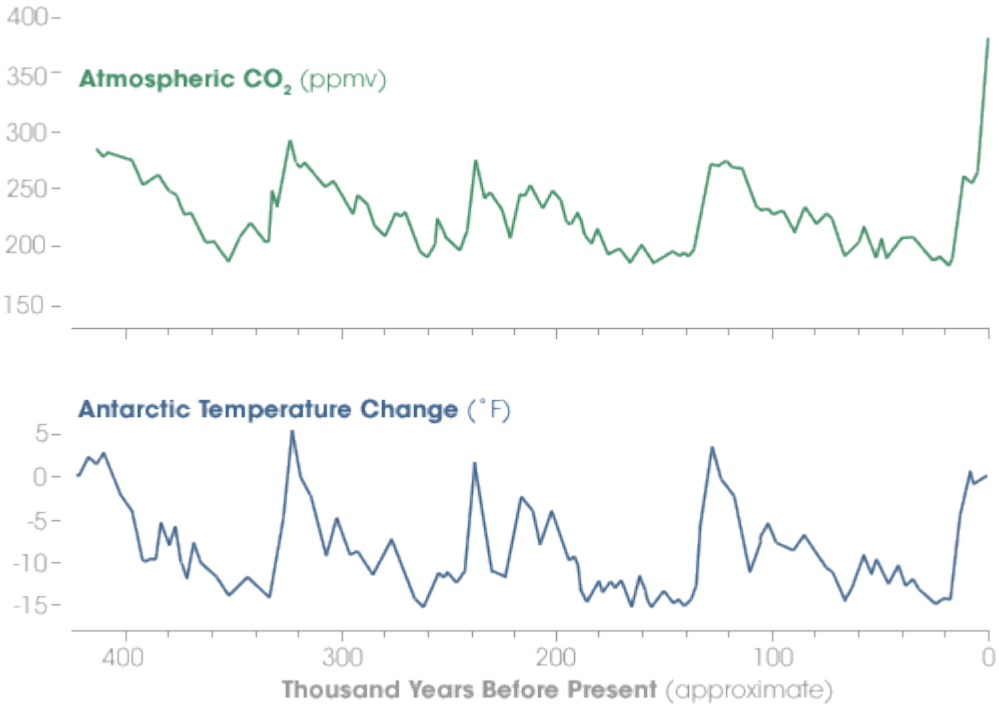
The Mathematical Concept or "key idea" that this activity will be used to teach:

- Standard 1: Students will use mathematical analysis and scientific inquiry to pose questions, seek answers, and develop solutions.

The Science Concept or "key idea" that this activity will be used to teach:

- Key Idea 7 (The Living Environment): Human decisions and activities have had a profound impact on the physical and living environment.

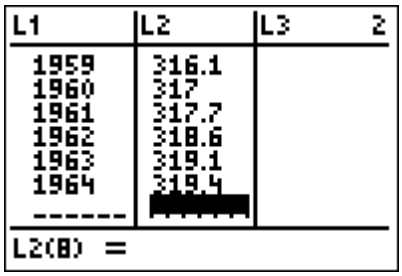
As part of an in-depth study of how humans impact the environment, students will be investigating the hot topic of climate change. Students will enter the room and will be seated in groups of four. On their table will be two unlabeled graphs. One will show atmospheric CO_2 level and one will show temperature change over the past 400,000 years taken from ice core data. All the words from the graphs will be removed. The only thing they will have to inform them are the numbers and the lines on the graph. They will make a list of observations about each graph (shape, trends, etc.) and then they will compare the two graphs. How are they similar/different? They will speculate as a group what the meaning of these mysterious data might be. We will debrief as a whole class, writing ideas down on chart paper to be posted in the room. The graphs I'm using will look like this (the words "Atmospheric CO_2" and "Antarctic Temperature Change" will be removed)



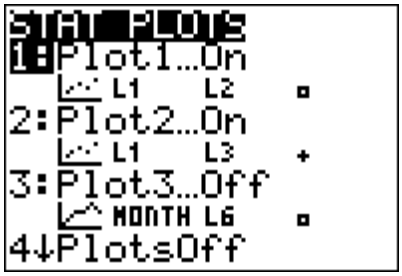
Students will then participate in a "Building Background Knowledge" workshop in which they will walk around the room observing a series of images from the Time magazine special edition http://www.time.com/time/archive/preview/0,10987,1176980,00.html This will be done silently while students are taking notes. After 15 minutes students will return to their tables and generate a list of what they noticed, what they learned, what questions remain. These will be posted on chart paper and posted alongside the chart concerning the mystery text. Finally, students will return to the mystery text (graphs above) and revise their thinking about what they think the graphs represent. As we complete this first day, the "mystery" will be revealed.

The following day, students will be issued graphing calculators and be divided into teams. Each team will be assigned a set of data to graph on the calculator. The four "greenhouse gases" being graphed will include: carbon dioxide, methane, CFC's, and Nitrous oxide.

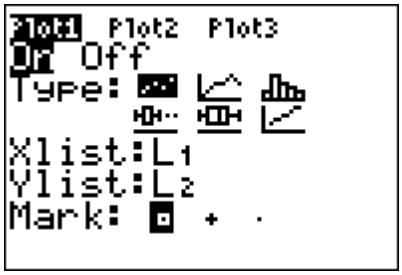
Students will enter the data into their calculators by hitting STAT and typing their data into columns L1 and L2. An example for CO_2 data is shown below:



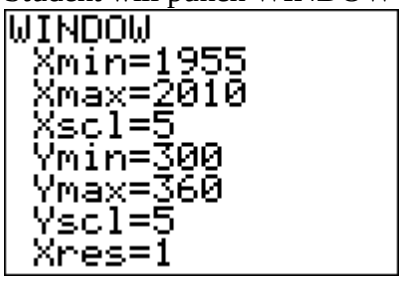
Once the data has been entered, students will create a graph of that data by punching 2nd STAT PLOT. This screen will appear:



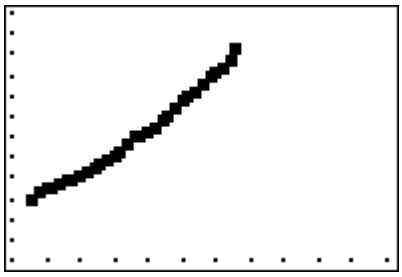
Student will hit ENTER and turn on plot1 and enter the following parameters.



Student will punch WINDOW and enter the following numbers:



Now hitting the GRAPH button will reveal the following graph:



The four graphs will be posted around the room. Each group will elect a "spokesperson" to represent them. This individual will explain the trend seen in the graph and will make a prediction about what can be expected to continue over the next 50 years. Slopes for different parts of the curve can be calculated so that students can see whether levels of gases are increasing at a steady rate or whether certain decades saw greater rates of change than others. The group that graphs CFC's will actually notice a decrease in the atmospheric levels of these gases over time, and they will have to research why that might be true.

Students will answer the following questions:

- What is the present level of your group's atmospheric gas?
- Why do you think the concentration of your atmospheric gas increased/decreased since 1955?
- What was the atmospheric level of your gas when you were born?
- What about when your parents where born (if they were born before 1955, extrapolated from the data)?

Give students data on approximate CO_2 emissions by nation. Data can be found at the Trends in Fossil Fuels site at the following web site
http://cdiac.esd.ornl.gov/trends/emis/tre_coun.htm

- Is the rate of carbon dioxide emission a factor of population concentration? Why?
- Are there any global patterns of emissions?
- How do these patterns compare to what you know about the development of countries around the world?

The homework assignment will be for each student to write a fact-based story illustrating a possible greenhouse-effect scenario. The story should be set in the future and begin, "If we knew in 2006 what we know now...." and then describe current conditions and how they might have been prevented if more was known about how human activities have influenced climate change.