The World Is Heating Up
Compiled by: Nancy Volk

Name: _____

Partner's name: _____

Interpreting Climate Data -- NASA as Earth scientists

View: "Piecing Together The Temperature Puzzle (5:48)".

1 What is the length of a decade?

2 What are three major life events that have happened to you in the past decade?

3 The last decade, according to NASA data, is the _____ recorded in human history of recording temperatures.

4 How long have humans been recording the temperatures of the earth?

5 What are some signs of raising temperatures?

6 What evidence do satellites provide for us that support the idea of global warming?

7 Is there evidence to support the idea that when the sun is very active it increases the temperature of the earth?

8 Explain how the brightness of the earth impacts the temperature of the earth.

9 What is the most abundant green house gas?

10 What is the second most abundant green house gas?

11 Explain the idea that increasing green house gases increase the temperature of the earth.

Before we take a look at some NASA climate data, let's review some information about graphs.

A What is an independent variable?

B What axis would represent the independent variable?

C What is a dependent variable?

D What axis would represent the dependent variable?

E A line graph should include what features?

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Mass and Volume Changes of a Substance
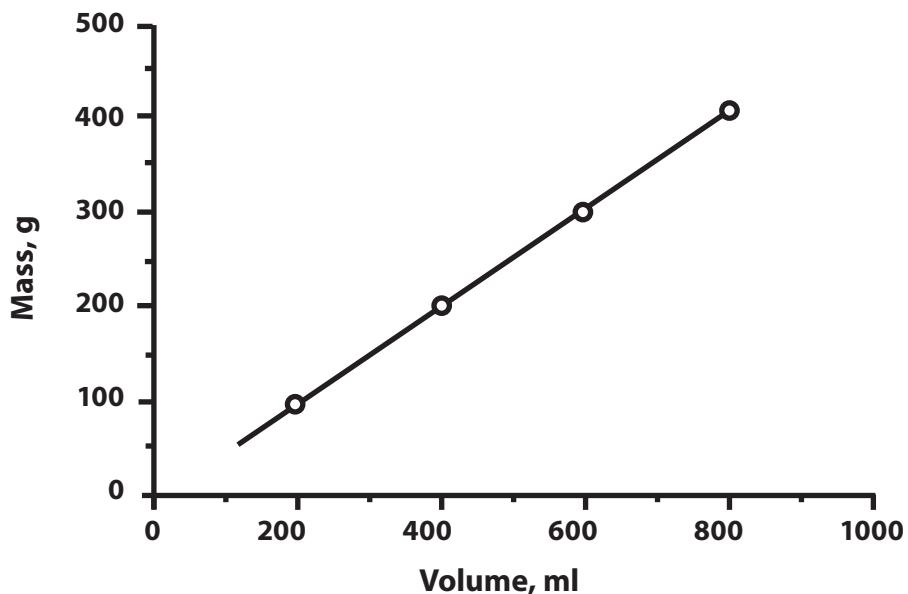
F What type of graph is illustrated above?

G What happens to the "y" value when the "x" value increases? Decreases?

Take a look at the following graph:

Cooling temperature of 50g of hot water
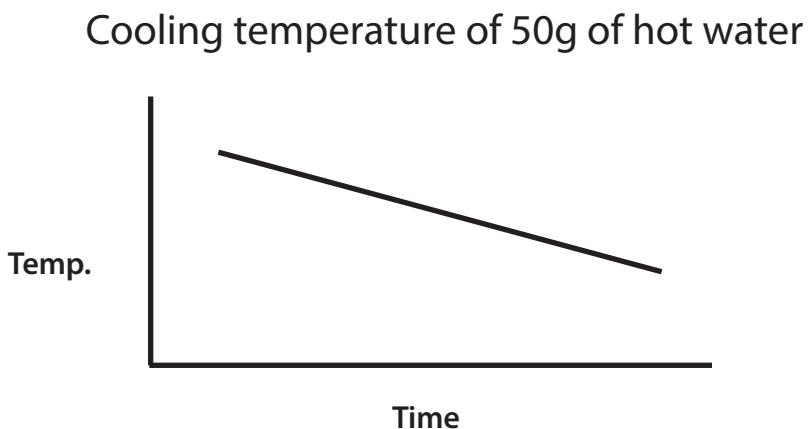
H What type of relationship does this graph demonstrate?

I As the value of the "x" axis increases, what happens to the "y" axis value?

J Predict what will happen as time continues?

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Take a look at the next graph:

Solar Radiation
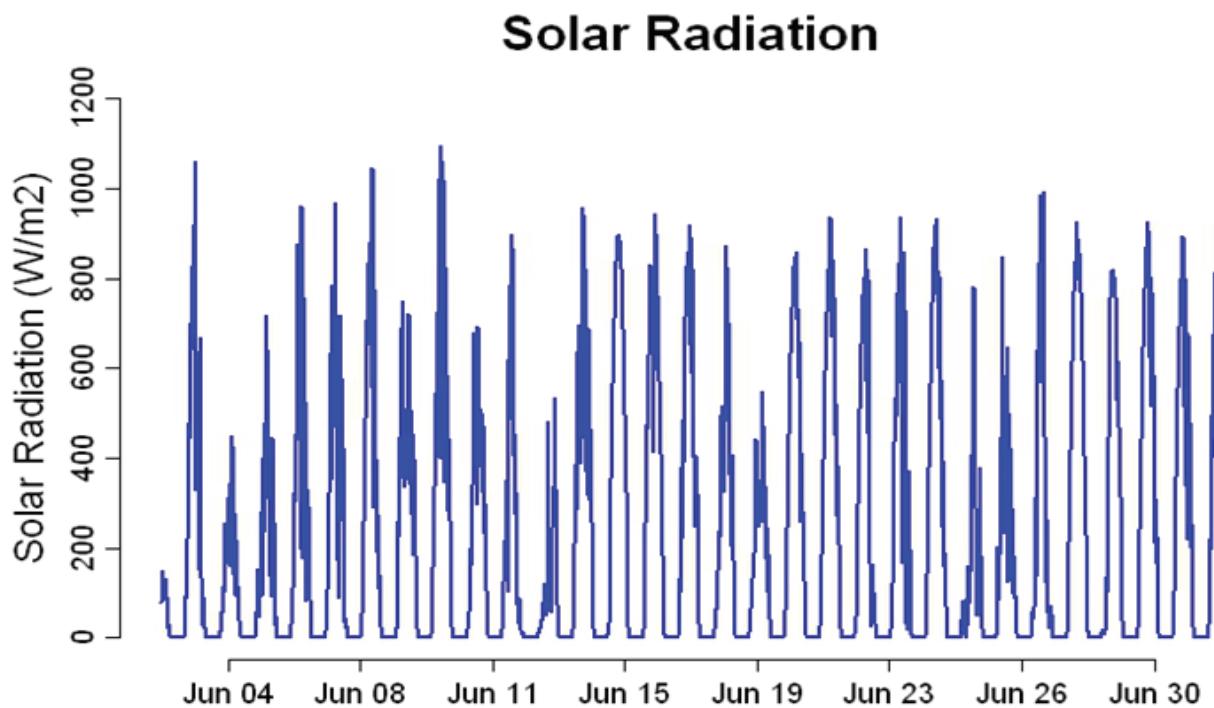
K What information does this graph tell us?

L What is the term for this type of graph?

Partner project:

Get together with a partner and discuss the graph you are given. Determine what is being measured, share the trend of the graph, and include any other pertinent information.
You will present your findings to the class after your team discussion.

Arctic Sea Ice

Data updated 10.10.11

AVERAGE SEPTEMBER EXTENT

Data source: Satellite observations.
Credit: NSIDC
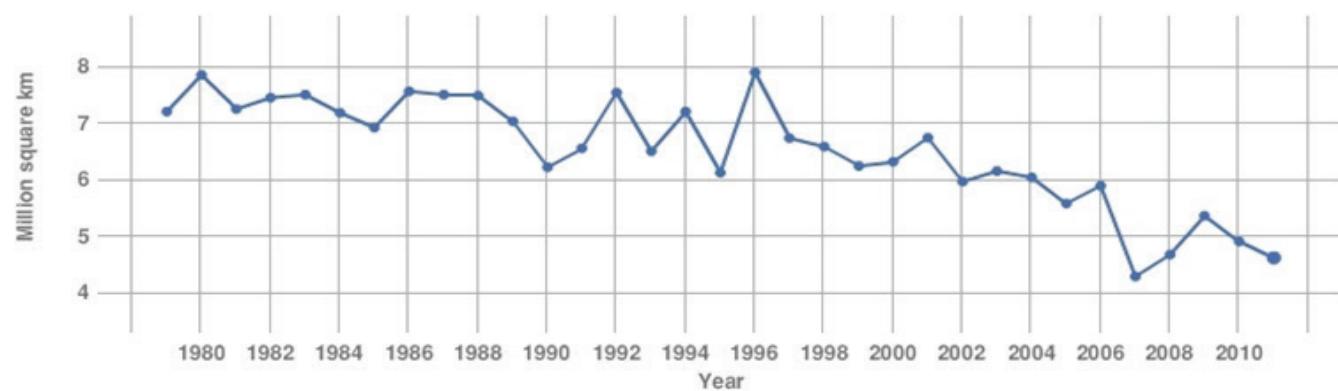
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Carbon Dioxide Concentration

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Data updated 03.30.12

PROXY (INDIRECT) MEASUREMENTS

Data source: Reconstruction from ice cores.
Credit: NOAA
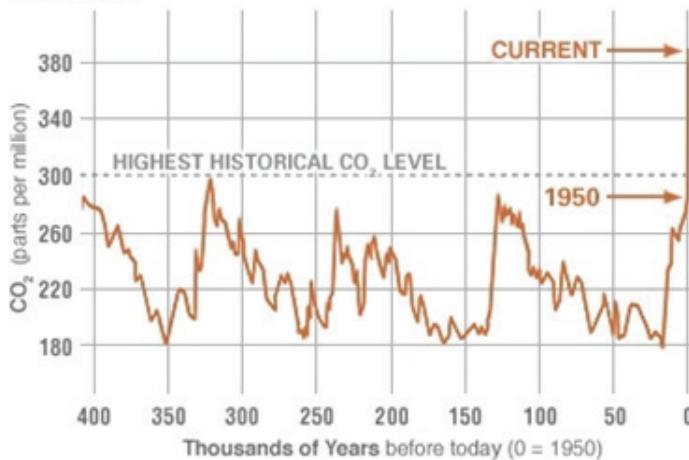
DIRECT MEASUREMENTS: 2005-PRESENT

Data source: Monthly measurements (corrected for average seasonal cycle). Credit: NOAA
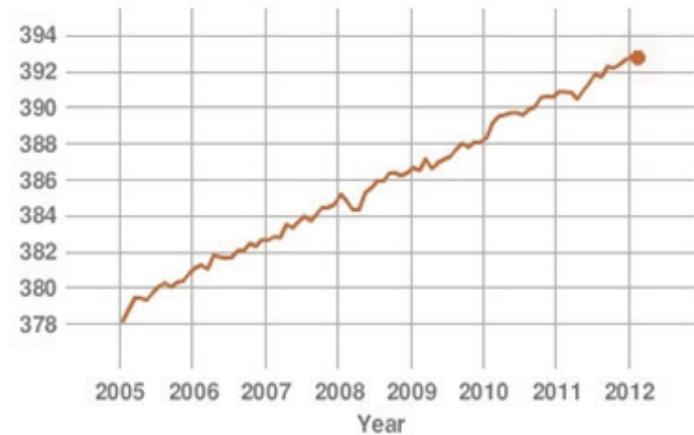

Global Surface Temperature

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Data updated 1.20.12

GLOBAL LAND-OCEAN TEMPERATURE INDEX

Data source: NASA's Goddard Institute for Space Studies (GISS) This trend agrees with other global temperature records provided by the U.S. National Climatic Data Center, the Japanese Meteorological Agency and the Met Office Hadley Centre / Climatic Research Unit in the U.K. Credit: NASA/GISS
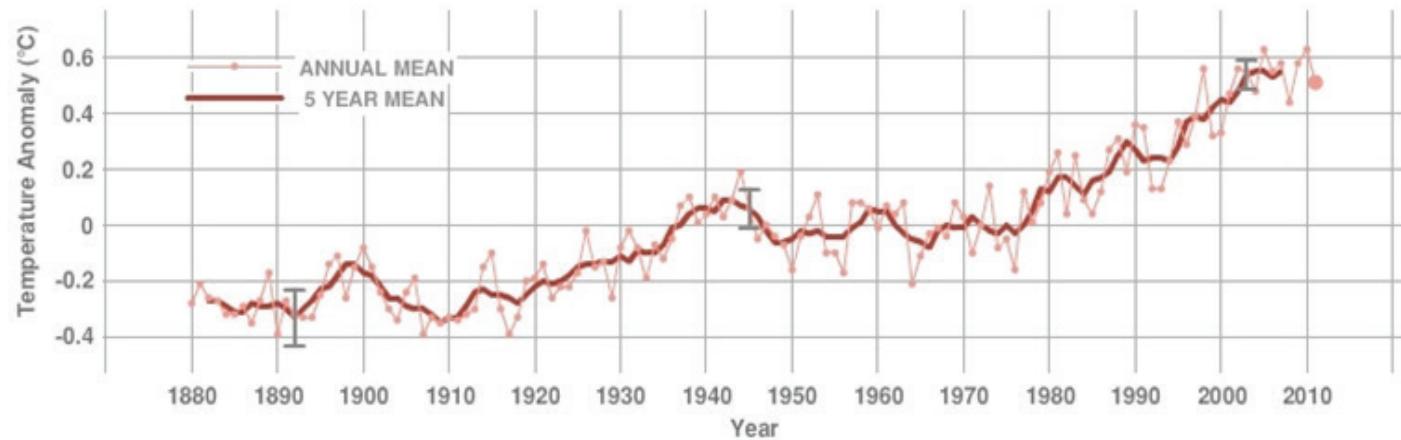
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Land Ice

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ANTARCTICA MASS VARIATION SINCE 2002

Data source: Ice mass measurement by NASA's Grace satellites.
Credit: NASA/University of California, Irvine
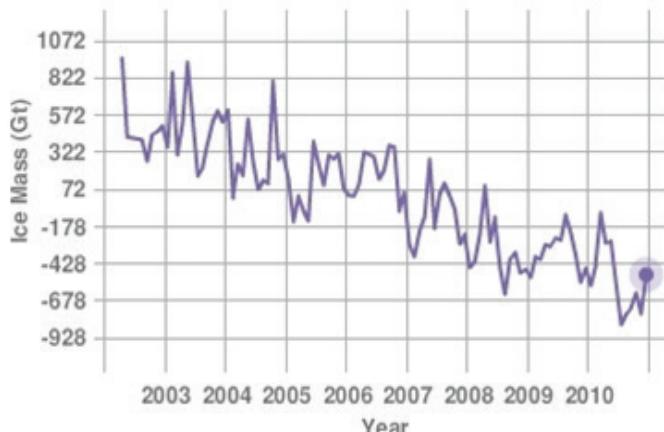
GREENLAND MASS VARIATION SINCE 2002

Data source: Ice mass measurement by NASA's Grace satellites.
Credit: NASA/University of California, Irvine
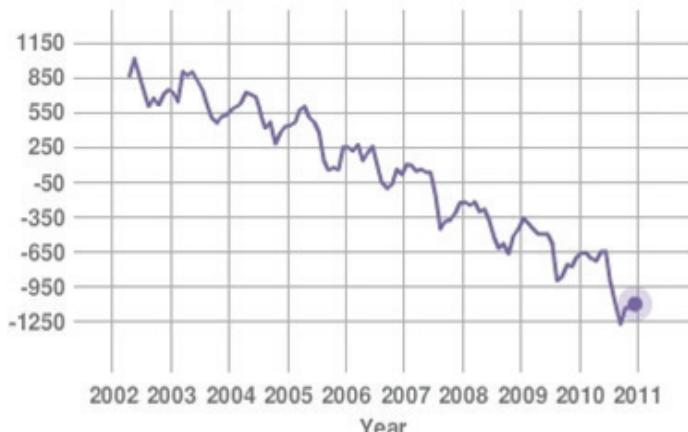
Note: In the above charts, mass change is relative to the average during the entire period. (Reference)

Sea Level

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GROUND DATA: 1870-2000

RATE OF CHANGE

↑1.70 mm*

Data source: Coastal tide gauge records.
Credit: CSIRO

SATELLITE DATA: 1993-PRESENT

RATE OF CHANGE

↑3.17 mm

Data source: Satellite sea level observations.
Credit: CLS/Cnes/Legos
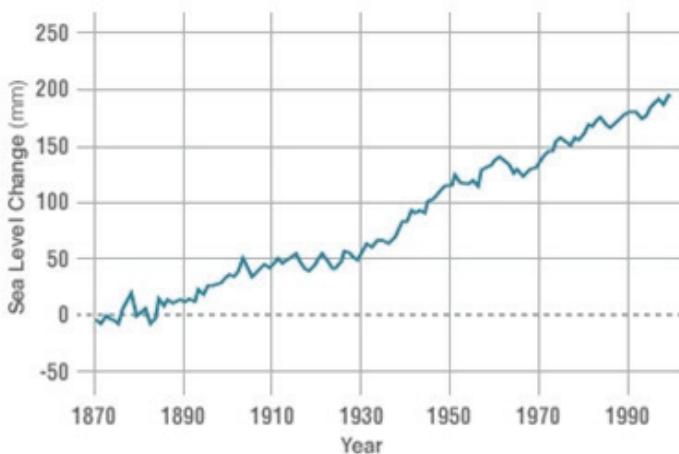
*estimate for 20th century
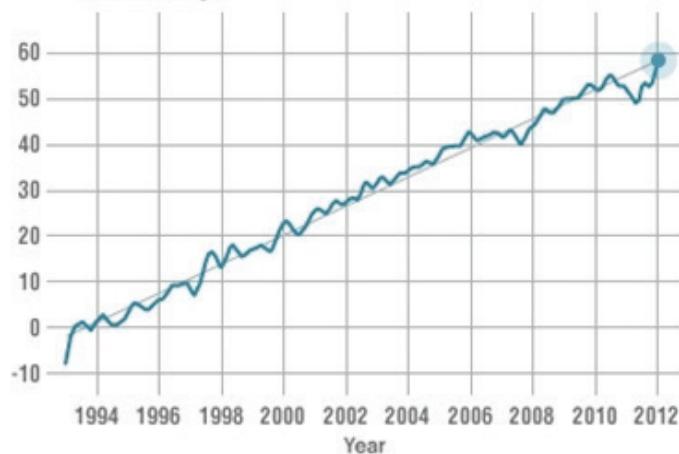
Inverse barometer applied and seasonal signals removed.

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Solar Radiation
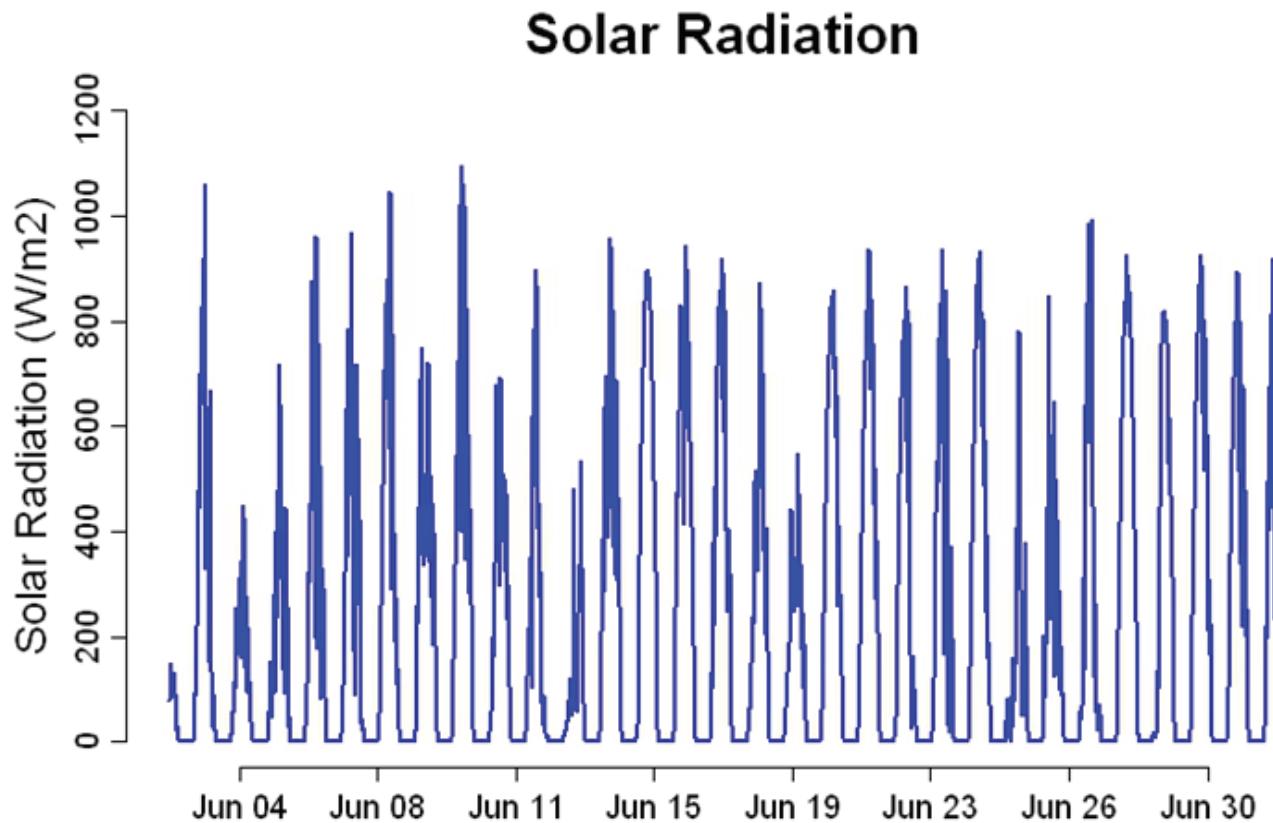
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Teacher Information:

Start the module by having the students view "Piecing Together The Temperature Puzzle (5:48)" written and produced by NASA. Go to: **http://climate.nasa.gov/imagesVideo/climateReel/**

Graphs:

1 What is the length of a decade? *10 years*

2 What are three major life events that have occurred to you in the past decade? *According to student responses.*

3 The last decade, according to NASA data, is the *hottest* recorded in human history of recording temperatures.

4 How long have humans been recording the temperatures of the earth? *150 years*

5 What are some signs of raising temperatures? *Increasing global temperature, decreasing ice coverage*

6 What evidence do satellites provide us that support the idea of global warming? *They help us track temperature, ocean currents, cloud coverage, precipitation, desert growth, etc*

7 Is there evidence to support the idea that when the sun is very active it increases the temperature of the earth? *There is evidence to support a slight rise in Earth's global temperature with a high solar activity. We are still studying this correlation. There is a much greater impact on our radio communication with high solar activity than on temperature of the surface of earth.*

8 Explain how the brightness of the earth impacts the temperature of the earth. *This is a complicated relationship. We are currently still studying this relationship. A brighter more reflective planet bounces more energy back into space and should reduce the temperature of the surface of Earth. Some of the brightest most reflective areas of our planet are covered with ice. These ice covered areas are shrinking and therefore this reduction of reflective surface adds to the temperature increase of earth. However, the clouds are also reflective. We believe that as the earth heats up so will the amounts of cloud coverage. As this increases there should be a cooling effect for the earth's surface. How much impact the cloud coverage will have on reducing the earth's temperature is unknown.*

9 What is the most abundant green house gas? *Water Vapor*

10 What is the second most abundant green house gas? *Carbon Dioxide*

11 Explain the idea that increasing green house gasses increases the temperature of the earth. *Increasing the greenhouse gases acts like adding a blanket around the earth. It traps warmer rays of energy closer to the earth surface and doesn't allow them to escape so easily. This effect warms the earth.*

Partner Project: Develop pairs of students that will work well together for this activity. Print out and if possible laminate the graphs provided. Hand one graph to each pair of students. Have the students discuss and write in their science notebooks information about the graph. They should include the title of the graph, the item being measured in the graph, the trends represented in the graph and other pertinent information. After the students have completed this step begin to have the partners share their graph and information. To assist with the student's presentation of information it might be helpful to project the graph from a computer screen. All the graphs appear on the Climate Day site for NASA:
http://climate.nasa.gov/keyIndicators/ or
http://climate.nasa.gov/evidence/

New York State Standards

Inquiry Based Process Skills:
Comparing and contrasting, gathering and organizing data, interpreting data, manipulating materials, measuring, predicting

Standard 1: Mathematical Analysis:
Key Idea 1: M1.1b, M1.1c
Key Idea 2: S2.3a, S2.3b
Key Idea 3: S3.2a, S3.3a, S3.4a

Skills and Strategies for Interdisciplinary Problem Solving:
Working effectively, gathering and processing information, presenting results

Standard 4: Key Idea 3: 3.1a, 3.1c, 3.1d, 3.1e, 3.1f, 3.2a