



CO₂ Emissions from Fossil-Fuel Burning

Quantitative

PURPOSE

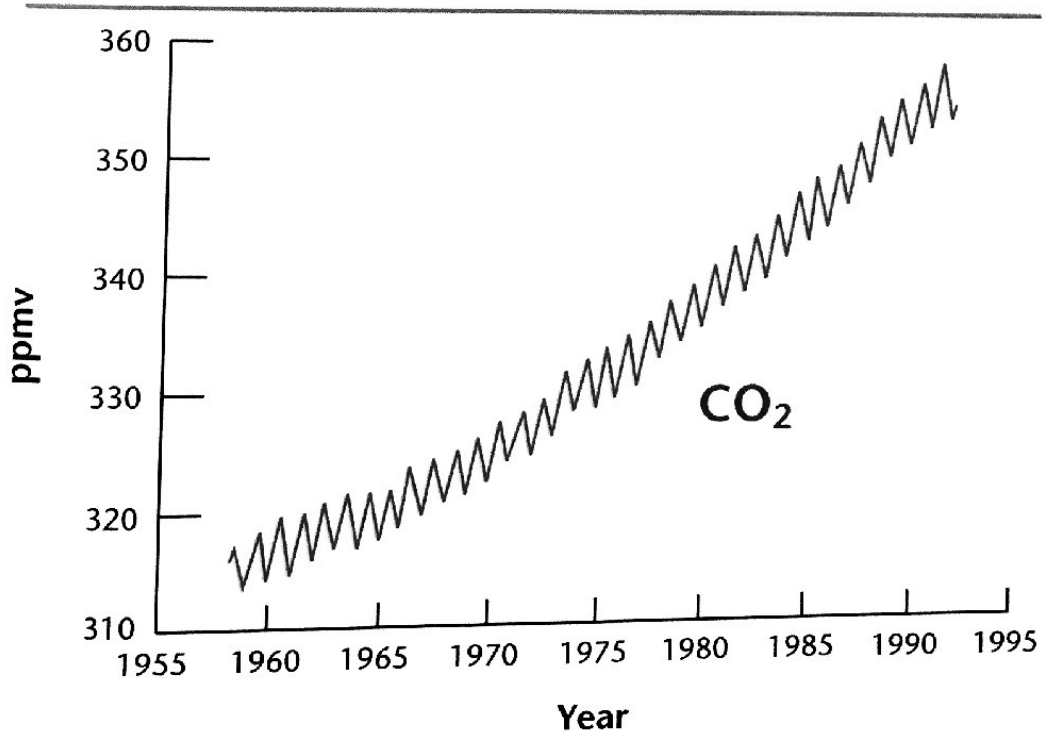
- Track long-term energy production (1751–2000) and correlate the data to emissions and atmospheric concentrations of CO₂
- Investigate the effects of CO₂ and other greenhouse gases on global temperatures

INTRODUCTION

In this investigation you will graph and analyze world-wide energy production historically and its effect on the accumulation of carbon dioxide in the Earth's atmosphere. You will access statistics from the year 1751 and continuing to the near present. The data will also allow you to track the history of technology as humans have proceeded from a mostly coal-burning economy to one exploiting all types of fossil fuel.

Fig. 24-1

Average carbon dioxide (CO₂) concentration in parts per million by volume (ppmv). The data were derived from continuous observations at the Mauna Loa Observatory in Hawaii.



Procedure

Step 1 Go to the following Web site and download the data:
http://cdiac.esd.ornl.gov/ftp/ndp030/CSVFILES/gloal.1751_2000.csv

If this Web site does not load, go to the following site:

http://cdiac.esd.ornl.gov/trends/emis/em_cont.htm

Select **Global**. An option now is to plot data from different parts of the world.

Step 2 You should now have data for about 250 years.

- Set up a graph plotting time on the x -axis and the level of carbon dioxide, in units of Millions of Metric Tons per Capita, on the y -axis.
- You may use pencil and paper, TI Interactive or Excel to plot the graphs. The data are comma-delimited and can be cut and pasted into Excel spreadsheet for analysis.
- Set the scales to reflect all the data values you have. (If you use pencil and paper, you may choose to plot just every other or every third data point, or plot only the last 200 years of data.)

Step 3 Plot the values for the three fossil fuels—natural gas, oil, and coal—on the same set of coordinates, using different colored lines.

1. How do your plots reflect the history of fuel use in the world?

2. Now plot the per capita data. What do these data imply? Why does the shape of the plotted data look as it does?

3. Suppose the total mass of Earth's atmosphere is about 5.1×10^{18} kg and is about 0.037% CO_2 . What was the percent increase in CO_2 as a result of the 2000 emissions?

Show all your calculations with proper units.

4. Find out where the CO_2 that is produced goes.

a. Identify and describe some of the carbon dioxide sinks in the natural world.

b. Describe how humans may be interfering with or inhibiting the sinks.

c. What is meant by anthropogenic sources?

Questions

5a. Identify and describe the sources of two other greenhouse gases that humans add to the atmosphere.

b. What are their effects on the ability of the atmosphere to hold heat?

c. Compare their heat-holding capacities to that of carbon dioxide.

d. How have their concentrations varied over time?

6. Match the increase in global atmospheric carbon dioxide with temperatures from 1880 to 2000, accessing the following Web page for data:

<http://yosemite.epa.gov/oar/globalwarming.nsf/content/climate.html>

a. Describe how temperature has varied with the increase of carbon dioxide.

b. Do the data show a direct cause-and-effect relationship? Why or why not?
