



This is the Keeling Curve, derived by researchers at the Mauna Kea observatory from atmospheric carbon dioxide measurements made between 1958 and 2005. The concentration is given in parts-per-million (PPM) which means one molecule of carbon dioxide is present for every 1 million molecules of air in the sample. The accompanying data, in Excel spreadsheet form, for the period between 1982 and 2008 is provided at

<http://spacemath.gsfc.nasa.gov/data/KeelingData.xls>

Problem 1 - Based on the graphed data, is the rate of carbon dioxide concentration decreasing, increasing or staying about the same?

Problem 2 – About what is the annual concentration rate between 1980 and 2005? Is it positive, negative or zero, and what does the sign of your number indicate?

Problem 3 - What would you predict as the carbon dioxide concentration for the year 2050?

Data from: C. D. Keeling, S. C. Piper, R. B. Bacastow, M. Wahlen, T. P. Whorf, M. Heimann, and H. A. Meijer, Exchanges of atmospheric CO₂ and ¹³CO₂ with the terrestrial biosphere and oceans from 1978 to 2000. I. Global aspects, SIO Reference Series, No. 01-06, Scripps Institution of Oceanography, San Diego, 88 pages, 2001. Excel data obtained from the Scripps CO₂ Program website at http://scrippsco2.ucsd.edu/data/atmospheric_co2.html

Problem 1 - Based on the graphed data, is the rate of carbon dioxide concentration decreasing, increasing or staying about the same?

Answer: **The rate is increasing because as time goes on, the concentration is getting larger.**

Problem 2 – About what is the annual concentration rate between 1980 and 2005? Is it positive, negative or zero, and what does the sign of your number indicate?

Answer: Students may use a ruler and draw a line that passes through the curve. In 1980 the concentration is about 335 ppm, and in 2005 it is about 380 ppm, so the rate is about $R = (380-335)/(2005-1980) = +1.8$ ppm/year. The positive sign means that the concentration is **increasing** with time.

Problem 3 - What would you predict as the carbon dioxide concentration for the year 2050?

Answer: Students may use a ruler to extend the line they drew in Problem 1 and 2 to 2050. Looking across to the vertical axis, the estimated concentration is about **455 ppm**. This is a 50% increase from its value in 1960!