Sampling Carbon Dioxide

Background:

Carbon Dioxide

Carbon dioxide (CO_2) is emitted in a number of ways. It is emitted naturally through the carbon cycle and through human activities like the burning of fossil fuels.

Natural sources of CO_2 occur within the carbon cycle where billions of tons of atmospheric CO_2 are removed from the atmosphere by oceans and growing plants, also known as 'sinks,' and are emitted back into the atmosphere annually through natural processes also known as 'sources.' When in balance, the total carbon dioxide emissions and removals from the entire carbon cycle are roughly equal.

Since the Industrial Revolution in the 1700's, human activities, such as the burning of oil, coal and gas, and deforestation, have increased CO_2 concentrations in the atmosphere. In 2005, global atmospheric concentrations of CO_2 were 35% higher than they were before the Industrial Revolution.

Bromothymol blue is yellow in acidic solution and blue in basic solutions. When CO_2 is in solution it reacts with water molecules by the reaction $H_20 + CO_2 ====> H_2CO_3$ an acid. Therefore if there is CO_2 in solution bromothymol blue will turn yellow.

Source: EPA

http://www.epa.gov/climatechange/emissions/co2.html

Science Content Standards:

Grade3:

P.S. 1.g. Students know that when two or more substances are combined, a new substance may be formed with properties that are different from those of the original materials.

L.S.3. c. Students know living things cause changes in the environment in which they live: some of these changes are detrimental to the organism or other organisms, and some are beneficial.

Grade 5:

P.S. a. Students know that during chemical reactions the atoms in the reactants rearrange to form products with different properties. f. Students know differences in chemical and physical properties of substances are used to separate mixtures and identify compounds.

g. Students know properties of solid, liquid, and gaseous substances, such as sugar (C_6HO_6), water (H_2O), helium (He), oxygen (O_2), nitrogen (N_2), and carbon dioxide (CO_2).

L.S. f. Students know plants use carbon dioxide (CO_2) and energy from sunlight to build molecules of sugar and release oxygen.

Grade 9-12

Chemistry

Conservation of Matter and Stoichiometry

a. Students know how to describe chemical reactions by writing balanced equations.

Ecology

d. Students know how water, carbon, and nitrogen cycle between abiotic resources and organic matter in the ecosystem and how oxygen cycles through photosynthesis and respiration.

Earth Sciences

Energy in the Earth System

d.* Students know the differing greenhouse conditions on Earth, Mars, and Venus; the origins of those conditions; and the climatic consequences of each.

Biogeochemical Cycles

a. Students know the carbon cycle of photosynthesis and respiration and the nitrogen cycle.

b. Students know the global carbon cycle: the different physical and chemical forms of carbon in the atmosphere, oceans, biomass, fossil fuels, and the movement of carbon among these reservoirs.

Structure and Composition of the Atmosphere

b. Students know how the composition of Earth's atmosphere has evolved over geologic time and know the effect of outgassing, the variations of carbon dioxide concentration, and the origin of atmospheric oxygen.