Carbon Dioxide

Carbon dioxide is a colorless gas with a faintly irritating odor and a slightly sour taste. The sour taste is the result of the formation of carbonic acid when CO_2 dissolves in the water in saliva. It is a stable gas that does not burn or support combustion. At temperatures lower than 31°C and at pressures higher than 72.9 atm, CO_2 condenses to the liquid form. A phase diagram for CO_2 is found in the chapter review section of Chapter 10. At normal atmospheric pressure, solid CO_2 (dry ice) sublimes at –78.5°C. The linear arrangement of carbon dioxide molecules makes them nonpolar.

CO_2 is produced by the burning of organic fuels and from respiration processes in most living things. Most CO_2 released into the atmosphere is used by plants during photosynthesis. Recall that photosynthesis is the process by which green plants and some forms of algae and bacteria make food. During photosynthesis, CO_2 reacts with H_2O, using the energy from sunlight. The relationships among the various processes on Earth that convert carbon to carbon dioxide are summarized in the diagram of the carbon cycle, which is pictured below.

Carbon Monoxide

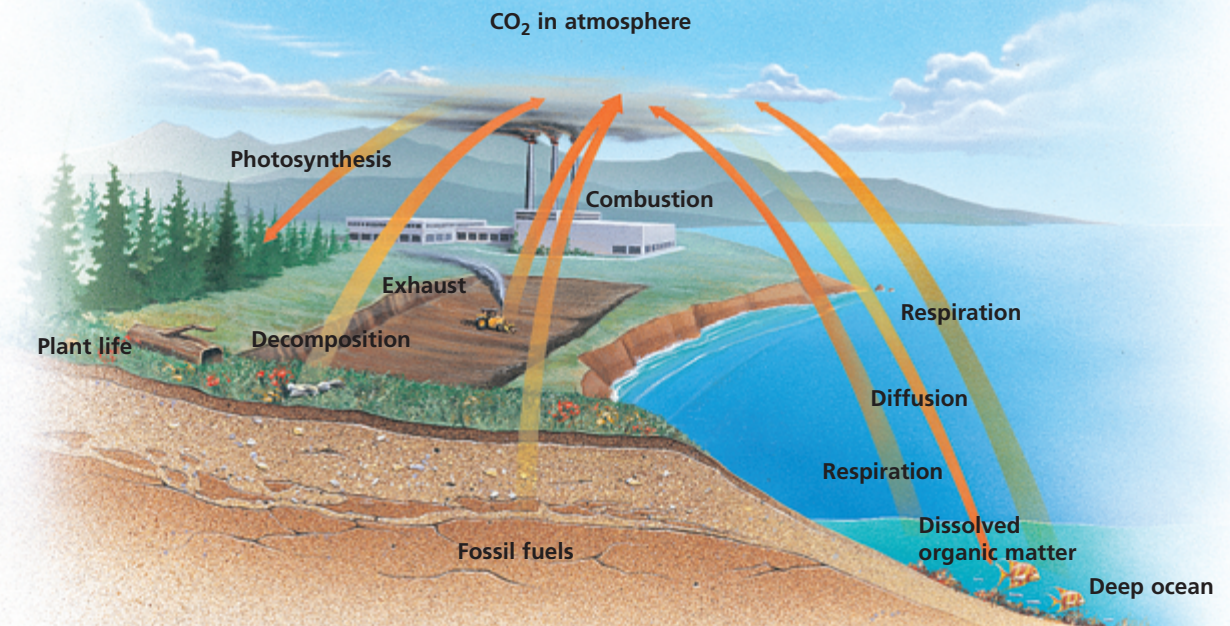
Carbon monoxide is a poisonous gas produced naturally by decaying plants, certain types of algae, volcanic eruptions, and the oxidation of methane in the atmosphere.

Because CO is colorless, odorless, and tasteless, it is difficult to detect. It is slightly less dense than air and slightly soluble in water. Its main chemical uses are in the reduction of iron, described on page 814, and the production of organic compounds, such as methanol.

$$CO(g) + 2H_2(g) \longrightarrow CH_3OH(l)$$

Carbon monoxide is also produced during the incomplete combustion of organic fuels. Incomplete combustion of methane occurs when the supply of oxygen is limited.

$$2CH_4(g) + 3O_2(g) \longrightarrow 2CO(g) + 4H_2O(g)$$



The processes that recycle CO_2 are collectively called the carbon cycle.