

**FIGURE 1-14** Various nonmetallic elements: (a) carbon, (b) sulfur, (c) phosphorus, and (d) iodine

## Copper: A Representative Metal

Copper has a characteristic reddish color and a metallic luster. It is found naturally in minerals such as chalcopyrite and malachite. Pure copper melts at  $1083^{\circ}\text{C}$  and boils at  $2567^{\circ}\text{C}$ . It can be readily drawn into fine wire, pressed into thin sheets, and formed into tubing. Copper conducts electricity with little loss of energy.

Copper remains unchanged in pure, dry air at room temperature. When heated, it reacts with oxygen in air. It also reacts with sulfur and the elements in Group 17 of the periodic table. The green coating on a piece of weathered copper comes from the reaction of copper with oxygen, carbon dioxide, and sulfur compounds. Copper is an essential mineral in the human diet.

## Nonmetals

Many nonmetals are gases at room temperature. These include nitrogen, oxygen, fluorine, and chlorine. One nonmetal, bromine, is a liquid. The solid nonmetals include carbon, phosphorus, selenium, sulfur, and iodine. These solids tend to be brittle rather than malleable and ductile. Some nonmetals are illustrated in Figure 1-14.

Low conductivity can be used to define nonmetals. A **nonmetal** is an element that is a poor conductor of heat and electricity. If you look at Figure 1-12, you will see that there are fewer nonmetals than metals.

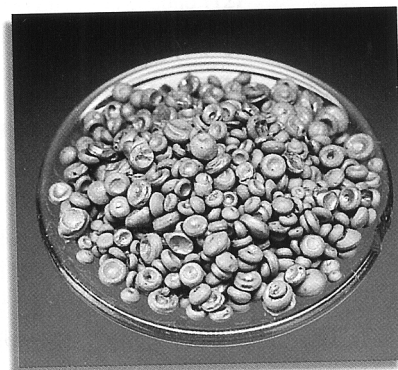
## Phosphorus: A Representative Nonmetal

Phosphorus is one of five solid nonmetals. Pure phosphorus is known in two common forms. Red phosphorus is a dark red powder that melts at  $597^{\circ}\text{C}$ . White phosphorus is a waxy solid that melts at  $44^{\circ}\text{C}$ . Because it ignites in air, white phosphorus is stored underwater.

Phosphorus is too reactive to exist in pure form in nature. It is present in huge quantities in phosphate rock, where it is combined with oxygen and calcium. All living things contain phosphorus.

## Metalloids

A stair-step line separates the metals from the nonmetals on the periodic table. Several of the elements in the vicinity of this line are often



**FIGURE 1-15** Selenium is a nonmetal, though it looks metallic.