Name: _____ Date: _____

Master 2-2

# Pollutants

## Particles

Particles make up one category of air pollutants. Particles are also called particulate matter. Particle pollution is a mix of very small pieces of solid materials and small drops of liquid in the air. The solid pieces can include dust, metals, smoke, soot, soil, or even ash from the eruption of volcanoes. Some of the solid particles may be large enough for you to see. Other particles are so small that they can only be seen using a powerful microscope. It may be difficult to understand the size of particles that are a problem in air pollution. The particles that scientists are most worried about are less than 10 micrometers in size. A micrometer is 1/1000 of a millimeter. The smallest particles are the ones that can cause serious health problems because they can get into people's lungs and into a person's bloodstream. The smallest particles are less than 2.5 micrometers. How small is 2.5 micrometers? The average human hair is about 30 times thicker than a particle of this size.

Where do these particles come from? Some of the particles get into the air from work at construction sites, unpaved roads, factory smokestacks, and wildfires. Many of the very small particles form from chemical reactions between gases in the atmosphere. The gases come from power plants, industries, and motor vehicles. Other particles can come from burning wood (either for a fire in a fireplace or from a forest fire) or cigarette smoke.

Particle pollution can occur during any season of the year. It can also affect areas very far away. For example, particles in the exhaust from a diesel truck in Los Angeles may end up over the Grand Canyon in Arizona.

## Carbon Monoxide

Carbon monoxide is a category of air pollution. Carbon monoxide is a colorless and odorless gas that is produced during the burning of fuels. You may know something about carbon monoxide because you have a carbon monoxide detector in your home. If the furnace is not working correctly, carbon monoxide gas may fill your home. Carbon monoxide can make you sick or even cause death at high levels. Most of the carbon monoxide that adds to air pollution comes from the fuels burned by cars, trucks, and other motor vehicles. Fires also add carbon monoxide to the air. Carbon monoxide levels are usually highest when the weather is cold. Cold temperatures cause less complete burning of fuels.

## Ozone

Ozone is a category of air pollution. Ozone is a gas made up of three oxygen atoms. You may have heard about ozone before—either as part of the ozone layer or as part of discussions about global climate change.

Ozone can be either good or bad depending on where it is. Regardless of where it is located, ozone has the same structure. "Good" ozone is found naturally in the atmosphere about 10 to 30 miles above Earth's surface. This ozone is very important because it protects Earth from the sun's harmful rays. The bad ozone is the ozone that is found much closer to Earth's surface. This bad ozone usually forms when different gases react in sunlight. The gases that form ozone usually come from factories, electric power plants, and vehicle exhaust. The vapors from gasoline and other chemicals add to ozone formation.

Ozone pollution is more common during the warmer months of the year because sunlight is important for the reaction between gases. Many cities have higher levels of bad ozone because of the higher number of motor vehicles and factories. Rural areas are also affected because wind can carry ozone to places far away.

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## Nitrogen Oxide

Nitrogen oxides are a common category of air pollution. These gases include an atom of nitrogen and one or more atoms of oxygen. Nitrogen oxides form from the emissions of motor vehicles, power plants, and off-road equipment. Nitrogen oxides, when they react with other gases, form the bad ozone that stays near the ground. They can also add to particle pollution. Nitrogen oxide can cause health problems for people with asthma and other respiratory diseases.

## Sulfur Dioxide

Sulfur dioxide is a colorless gas. It is produced when fuels that contain sulfur are burned. Sulfur-containing fuels include coal and oil. Power plants, refineries, and other industries are major sources of sulfur dioxide. Other sources include the burning of fuels by trains, large ships, and off-road equipment. Sulfur dioxide can cause health problems for people with asthma and other respiratory diseases.

## Lead

A sixth major category of air pollutants is lead. Lead is a metal found naturally in the environment and in manufactured products. A major source of lead in air pollution used to be gasoline and other fuels. However, in the 1970s, the amount of lead in gasoline decreased and by the mid 1990s, all gasoline was lead-free. Because of this change in gasoline, the amount of lead in the air is much lower now than in the past. Today, the highest levels of lead in the air are around lead smelters where lead ore is processed to produce the pure metal. Other stationary sources are waste incinerators, utilities, and lead-acid battery manufacturers.