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| **Directions:** |
| Work through all of the topics in the lesson guide, then continue to the activity and posttest. |

**The Respiratory System**Respiratory System illustrationThe Respiratory System is the group of organs in the body that is responsible for breathing. Try taking a breath. When you inhale, you are pulling fresh, oxygen containing air into your lungs to be absorbed. Now breathe out. When you exhale, you push the stale air containing carbon dioxide (CO2) out of your lungs.Unfortunately, if air pollution is present in the air you breathe, it too can enter the respiratory system with every breath. The major harmful effects to human health from air pollution occur in the lungs. Children are particularly susceptible to environmental pollutants that enter the respiratory system and eventually reach the lungs for several reasons:* Children tend to spend more time engaging in physical activities outdoors than do adults.
* Children breathe through their mouths more often than adults, thus bypassing the filtering and removal of air pollutants that occurs by breathing through the nasal passages.
* Children's air passages are smaller than adults.  Irritation caused by air pollutants can cause air passages to swell. Since their air passages are smaller, it is more difficult for children breathe with partially blocked air passages.

Continue this lesson to find out more about specific types of air pollutants. |

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| Image: Indoor air pollutants can include dust, mold, and chemicals used in building materials**Indoor Air Pollutants**An indoor air pollutant is a substance that is present inside buildings that has a harmful health effect on the occupants of the building. Since most people spend more time indoors than outdoors, exposure to indoor air pollutants is an important environmental hazard.Indoor air pollutants have become a serious problem in recent years due to efforts by builders to make homes and other buildings more energy efficient.  Modern buildings are built to restrict the flow of air from the inside out and vice versa. These new building practices work well to save energy. However, reduced airflow in a building can cause air quality problems in three ways.* New buildings contain new types of insulation that are developed to help us use less air conditioning during the summer and less heating during the winter.  This new insulation can add to indoor air pollution because of chemicals, like Image: Indoor air pollutants may cause symptoms like sneezing, itchy eyes, coughing, and wheezingformaldehyde, used to make the newer types of insulation.
* Reduced amounts of outside air entering a building can cause the levels of air pollutants to build up over time and become greater than outdoor levels of air pollution.
* Large air conditioning and heating units have lots of air duct space for molds and bacteria to grow in.

There are many types of indoor air pollutants.  Go to the next page to find out about different types of indoor air pollution. |

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| Indoor Air Pollutants

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| **List of Common Indoor Air Pollutants** |
| **Name** | **Symptoms** | **Source** | **Solution** |
| Formaldehyde | Eye irritation, nasal congestion, rash, headache, nausea, and vomiting. | Used in particleboard, insulation, and carpeting | Increase ventilation after new carpet/insulation is installed by opening windows, or using fans. |
| Molds | Allergic symptoms such as sneezing, eye irritation, coughing, and wheezing. In severe cases may cause bleeding in the lungs. | Molds thrive in damp environments. | Routinely check for water damage to buildings. Clean air ducts regularly. |
| Combustion Product | Eye irritation, coughing, wheezing, and worsening of asthma | Use of unventilated space heaters, kerosene lamps or heaters, and gas ovens. | Do not use improperly vented space heaters indoors. |
| Nitrogen Dioxide (NO2) | Irritation of eyes and throat, respiratory difficulties, common cold, and worsening of asthma. | Natural gas, coal, kerosene, or wood fueled cooking appliances. | Keep kitchens with  non-electric ranges well ventilated. |
| Carbon Monoxide (CO) | Difficult breathing, heart disease, blood coagulation, mental impairment and possible death. | Incompletely burned hydrocarbons from gasoline engines, etc. | Use proper fuel for vehicles and provide regular maintenance.  Use CO detectors in homes and cars. |
| Tobacco Smoke | Eye, ear, nose and throat irritation and infection.  Risk of lung cancer, heart disease and other chronic illnesses. Habit forming. | Smoking cigarettes and other tobacco products. | Avoid smoking cigarettes (actively or passively).  Increase ventilation when tobacco smoke is present. |

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| **Outdoor air pollutants**Outdoor air pollutants pose a special problem for people such as home builders and farmers who work outside.Image: Urban workers may be exposed to high levels of ozone, dust, and gasoline exhaust productsUrban residents are typically exposed to such outdoor air pollutants as ozone, particulate matter (dust and smoke), and mixtures that contain chemicals like benzene, and xylene (found in gasoline.) In addition, sulfur compounds, carbon monoxide, nitrogen dioxide, and compounds containing bromine and chlorine may be found in the air in urban areas.  Levels of these pollutants are measured in terms of ozone levels.  As ozone levels increase, levels of all other air pollutants tend to increase.image: Farm workers may be exposed to grain dust and toxins found on moldy grain.The outdoor air pollutants that rural residents are exposed to are slightly different from pollution encountered in urban areas. Agricultural workers, for example are at risk to being exposed to grain dust and toxic residues from moldy grains such as aflatoxin.  Heavy exposure to grain dust can cause a respiratory disease called Farmer's Lung.  Exposure to aflatoxins can cause cancer.Outdoor air pollutants, regardless of their source, tend to cause or worsen respiratory problems such as asthma and emphysema.The best protection from outdoor air pollutants is to remain indoors, especially during ozone alerts.   When this is not possible, try to keep your level of activity to a minimum.   Also, wear a dust mask when working in a dusty environment.There are many types of outdoor air pollutants.  Go to the next page to find out more about different types of outdoor air pollution. |

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| **List of Common Outdoor Pollutants** |
| **Pollutant Name and Description** | **Symptoms** | **Source** |
| Carbon Monoxide (CO)A gas that is colorless, odorless, and at high levels, poisonous. | Blurred vision, reduced work capacity, reduced manual dexterity, poor learning ability, and difficulty in completing tasks.  | CO forms when carbon in fuel is not burned completely.  It is found in motor vehicle exhausts, industrial processes, non-transportation fuel combustion, and natural sources such as wild fires. |
| Nitrogen Dioxide (NO2) | Irritated lungs and less resistance to respiratory infections such as influenza.  Acute respiratory disease too in children. | Light brown gas.  Usually enters the air as a result of high temperature combustion processes, home heaters, and gas stores are also sources of NO2. |
| Ozone (troposphere) (O3) | Shortness of breath, chest pain, wheezing, and coughing. Bacterial pneumonia results from long term, repeated exposure to high levels of ozone.   | Highly reactive gas in form of oxygen.  Main component of air pollution known as smog.  Forms by action of sunlight on carbon-based chemicals, acting in combination with oxides of nitrogen. |
| Particulate Matter (PM) | Can trigger asthma attacks and cause wheezing, coughing, and respiratory irritation in individuals with sensitive airways. | Generic term for a type of air pollution that consists of complex and various mixture of particles. These solids include dirt, soil dust, pollens, molds, ashes, and soot.   |
| Sulfur Monoxide (SO) | Respiratory illness, alterations in the lung's defenses, and aggravation of existing cardiovascular disease. | Formed when fuel containing sulfur (mainly coal and oil) is burned.  Large industrial facilities have the highest monitored concentration of SO. |
| Benzene | Chronic exposure to a low dose can cause leukemia. Acute effects from a high dose are drowsiness, dizziness, rapid heart rate, headaches, tremors, confusion, and unconsciousness.  Death can occur from inhaling a very high level of benzene.  | Used in industrial plant as starting chemical for synthesis of plastic, nylon components, and synthetic detergents.  Also released into the environment from volcanoes and forest fires.  Gasoline pumps and tobacco smoke also discharge benzene into the air.  |
| Xylene  | Headaches, lack of muscle coordination, dizziness, confusion, impaired sense of balance, irritation of the skin, eye, nose, and throat, vomiting, and irritation of the stomach. | Colorless , sweet smelling gas.  Mostly a synthetic chemical produced from petroleum.  Also, a natural product of forest fires.  Found in airplane fuel, gasoline, and cigarette smoke. |
| Styrene | Dizziness, drowsiness, headaches, nausea, and weakness.  | Liquid that is colorless to yellow. Burning styrene produces toxic fumes. |
| Farmer's Lung Disease (Extrinsic Allergic Alveolitis) | Breathlessness, dry irritating cough,  sneezing spells, runny nose, congestion, itchy/watery eyes and wheezing are all symptoms of this disease.  | Allergic disease usually caused by breathing dust from moldy hay.  Can be caused by corn, silage, wheat, or even tobacco. |
| Aflatoxin | Liver damage or even liver cancer could result. | Mold that grows on crops such as peanuts, tree nuts, corn, wheat, and oil seeds. |

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| **Special Environments**Some environments can expose people to toxic chemicals and require special consideration. These include working with arts and crafts, child care/school settings, work places, and waste sites.**Arts and Crafts**illustrationThere are three major types of hazards when dealing with arts and crafts:* heavy metals (lead and mercury)
* organic solvents (paint thinners and cleaners)
* dust and fibers (asbestos, silica powders)

Unlike commercial house paint, art supplies are not regulated. Therefore many artists' paints contain metals such as lead, mercury, cadmium, and cobalt. Other supplies such as inks, glazes, pastels, enamels, and solder can also contain these metals.Organic solvents are used as cleaners, thinners and are even found in rubber cement. Organic solvents can cause irritation, nerve damage and death if ingested.Dust and fibrous material like asbestos, silica, talc, lead, cadmium and mercury are generated while mixing powdered pigments, glazes, clay, and pastels with water or oil. The fibers and dust can get into your lungs and cause scarring of the lungs or be absorbed into your blood stream.Many of the affects that these chemicals can cause can be avoided by following directions or avoiding use of art supplies with harmful contents. |

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| **Special Environments****Schools and Child Care Settings**Schools and child care settings can have many indoor hazards. They include asbestos, lead, carbon monoxide, radon, smoke (cigarettes), mycotoxins, and pesticides.Asbestos, lead, radon and carbon monoxide poisoning all pose a higher risk in older buildings but can occur in new buildings as well. It is important to check with school officials to see if these problems are a potential hazard or if steps have been taken to prevent them.Cigarette smoke is a larger problem in home day care units where smoking is permitted versus day care where smoking is not permitted. To avoid second hand smoke be sure to place your child in a setting that is smoke free.Mycotoxins and pesticides can pose a risk in any setting. Mycotoxins are produced by molds and can be avoided through proper cleaning and adequate ventilation. Pesticides are important to decrease the pest population but can be toxic to humans as well. Responsible spraying of pesticides will not only reduce hazards but will also reduce costs as well.**Work Places**Five million adolescents younger than 18 are legally employed in the US.  In addition about 1 to 2 million are employed in violation of wage, hour, or safety regulations. Adolescents younger than 18 are not allowed to work with hazardous chemicals or machinery. The biggest risk that work place chemicals pose to those under 18 is exposure through inhalation. It is important to read the Materials Safety Data Sheets (MSDS) that should be present near the chemical storage site. The MSDS will contain all the information that you need to determine the risk that each chemical poses.**Waste Sites**Waste sites are a cornucopia of hazards. They can cause ground, water, and air pollution. The other factor is that waste sites are often a tempting place to explore for children. This gives them direct exposure to hazardous materials. It is important obey all warning signs in and around waste sites. The amount of damage that exposure to waste sites can cause depends on the type of waste, the amount of hazardous materials, and the length of exposure. If unusual symptoms occur after exposure, it is important to contact a poison control center or see a doctor.  |