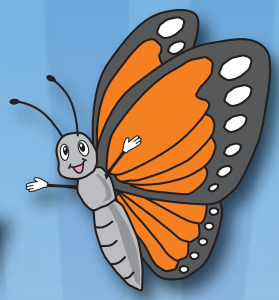
Air, Air, Everywhere



Teacher's Guide and Activities

GRADES 3-5

Wisconsin Department of Natural Resources

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To download electronic copies of this activity guide or to print the student worksheets, please visit:

http://dnr.wi.gov/eek/teacher/air.htm

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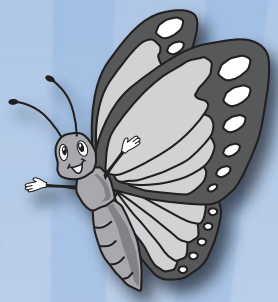
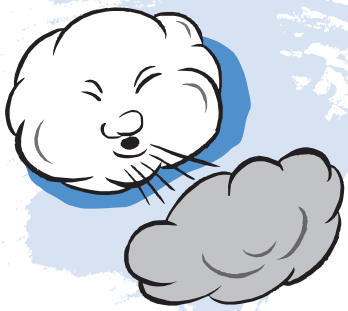


Contents

Introduction

Air can be difficult to teach about because you can't always see it, smell it, hear it, or taste it. But we cannot live without it, so learning how air quality affects our health and the health of our world is important. The pollution in the air, or "air hitchhikers," can do more than just look dirty, it can harm plants and wildlife, it can destroy buildings and surfaces, it can affect human health, and it can contribute to acid rain, ozone depletion, and climate change.

The quality of the air cannot be taken for granted. In previous generations, people burned large amounts of coal without pollution control equipment, turning our skies black. They put lead into gasoline to make engines run smoother, but didn't realize the lead was emitted into the very air we breathe. Burning of waste was common practice. These and other sources of air pollution degraded the air quality and affected public health.



We've also learned air pollution doesn't stay put. Polluted air can travel both very long distances and across our neighborhoods. If we produce air pollution in our backyards by burning trash, using woodfire boilers inappropriately, or idling our vehicle engines, it may move into our neighbor's yard, settle on nearby fields of crops, or end up in our water and contaminate fish and waterways.

Do you wonder if our air quality is getting worse, especially when you hear about air quality advisories? The quality of the air is actually improving, but the standards are also getting stricter. As scientists have learned more about how air pollution affects people, they have realized air pollution can cause adverse health effects at lower levels than those at which the standards were set originally. In response to new information, the U.S. Environmental Protection Agency (U.S. EPA) has tightened standards. Since the air quality standards are stricter, we may see more days where air pollution exceeds standards even though the air is as clean as or even cleaner than it used to be. The U.S. EPA and Wisconsin DNR are constantly working to reduce pollution emissions wherever possible to make sure we meet the most recent standards.

We have learned we cannot assume the air is clean. The quality of the air we breathe is important. We know air pollution can cause respiratory issues as well as cardiovascular problems. The quality of the air can also affect our immune systems—our defense against getting sick. Air quality can also influence the amount of oxygen our body receives. The more pollution in the air the less oxygen is able to travel into our bodies.

Outdoor air quality affects the respiratory health of EVERYONE. Air pollution can cause a spectrum of health effects—from mild eye, nose and throat irritation to an asthma attack. Some people may be more sensitive to air pollution due to their age, the amount of time they spend outdoors, or whether they have a respiratory ailment like asthma. Children are generally more sensitive to air pollution than adults because:

- **Children's respiratory organs are still developing** and thus are more sensitive to air pollution.
- **Children have narrower airways** that are more severely affected by tissue inflammation from poor air quality.
- **Children have weaker immune systems** that are more vulnerable to air pollution and the substances found in it.
- **Children breathe air faster and deeper into their lungs than adults.** This allows more pollution to enter and travel deeper into the lungs.
- **Children often breathe through their mouths instead of their noses.** Breathing through the mouth bypasses the mucus and cilia of the nose which are designed to catch "air hitchhikers" and stop them from entering the lungs.

For more information on asthma, visit EEK! (dnr.wi.gov/eek) and download the Asthma Basics reference sheet.

So where is all of this air pollution coming from?

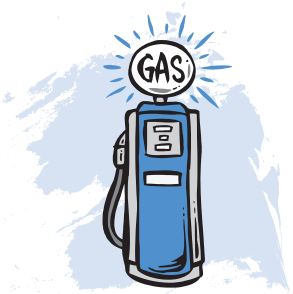
Well, lots of places. Each time you turn on a light in your house or turn on the air conditioner, you are using power generated by a power plant. Most power plants burn fossil fuels, such as coal, oil, or gas, to create energy for our use. Other tasks we do, such as mowing our lawn, driving to the store, or painting our home, all contribute to air pollution. The U.S. EPA monitors six criteria air pollutants: particle pollution, ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur oxides (SOx), and lead.

Particle Pollution

Particle pollution, also called haze or smog, is made up of tiny particles of almost any compound. Smoke, dust, water vapor, and chemicals can all be components of particle pollution. Particles can come from anywhere: driving down a dusty dirt road; smoke from burning wood, leaves, or trash; exhaust from

your vehicle; etc. Particles are then suspended in the air and can travel in air currents for very long distances. Most of the particles cannot be seen because they are so tiny. However, we do breathe them into our lungs and the smaller the particles the deeper into our respiratory system they can travel. When in our lungs, these particles can cause coughing and wheezing. Individuals with asthma or other respiratory ailments may notice these effects sooner. Particle pollution can also interfere with oxygen getting into the blood stream. This can cause shortness of breath and extra work for the heart.

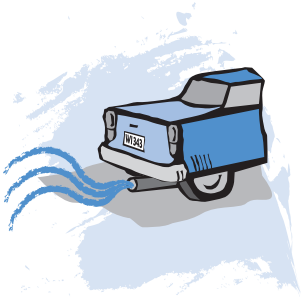
Ozone



Ozone is a colorless, odorless gas that reacts aggressively to just about anything with which it comes in contact with, including eye, nose, and throat tissue. Ozone is what we call a secondary pollutant. It is not directly emitted into the air, but rather forms from a chemical reaction between nitrogen oxides (NOx), volatile organic compounds (VOCs), and sunlight. NOx and VOCs primarily come from vehicle exhaust and power plant emissions. Ozone concentrations are at their greatest when the right conditions exist—hot sunny weather in the summer with plenty of NOx and VOCs present.

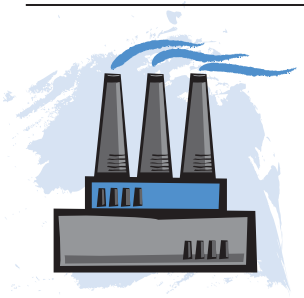
You may also have heard of the ozone layer. This protective layer high up in the atmosphere protects us from the sun's harmful ultraviolet rays. The ozone layer is created from naturally occurring ozone molecules, whereas ground level ozone does not occur naturally. And we don't breathe the ozone in the high-up ozone layer. A good way to remember the difference is to say, "Ozone is good up high, but bad nearby."

Carbon Monoxide



Carbon monoxide (CO) is another odorless and tasteless gas that is very harmful to human health. CO enters the lungs and binds to hemoglobin in the blood, taking the place of oxygen. When too many CO molecules are in the blood stream not enough oxygen is getting to the muscles, organs, and brain. So where does CO come from? CO is a byproduct of incomplete combustion, commonly found in vehicle engine emissions.

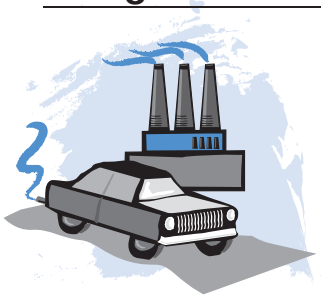
Carbon Dioxide



Carbon dioxide (CO_2) is emitted into the air through the burning of fossil fuels as well as with every breath we breathe out. Humans breathe in oxygen and breathe out CO_2. The good news is that trees and plants take in CO_2 and emit oxygen (the reverse of human and animal respiration). Plants help keep much of the CO_2 out of the atmosphere, but when we cut down trees that are storing CO_2 and then use those trees for fuel by burning them, we are not only reducing the overall amount of CO_2 that is respired by the tree, we are also emitting more CO_2 in the combustion process.

CO_2 is also well known because it is a greenhouse gas. A greenhouse gas is a gas in the atmosphere that traps the heat from the sun. On a natural scale, the greenhouse effect is very important for keeping the hospitable temperatures of our earth. However, when too much CO_2 is present in the atmosphere from the depletion of forested areas and the burning of fossil fuels and vegetation, the CO_2 in the atmosphere can trap too much of the sun's heat and cause the atmosphere to warm.

Nitrogen Dioxide and Sulfur Oxides

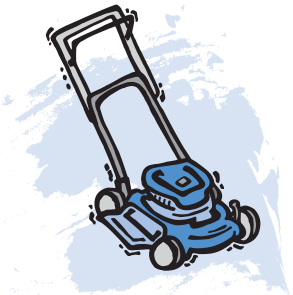


Commonly know as NOx and SOx, nitrogen dioxide and sulfur oxides are two major contributors to air pollution. The most common source of NOx is vehicle emissions while SOx is emitted from the burning of coal. Both can affect human health in much the same way that ground-level ozone can. The lungs can become irritated and people with asthma may have symptoms exacerbated.

Lead

Lead has been known to be a very dangerous substance for a long time. Lead can affect almost every system in the body from causing mild respiratory distress to central nervous system impairment. According to the U.S. EPA, now that we only use unleaded gasoline, the most significant source of lead exposure in the U.S. today is from the improper removal and discard of lead-based paints. If you suspect your home or school may have lead-based paint needing removal, please contact the National Lead Information Center for information.

Volatile Organic Compounds



VOCs, or volatile organic compounds, are all hydrocarbons. This means the compounds are all made up of hydrogen and carbon. VOCs are created mostly by vehicles, but can also come from industries that burn fossil fuels, ordinary house paint, charcoal lighter fluid, aerosol cans, motor boats, lawn mowers, permanent markers, and nail polish remover. Some sources of VOCs come from nature such as the spray from a skunk. VOCs are an important component in creating ground level ozone.

Air Toxics

Air toxics, or just toxics, are pollutants in the air that can cause serious human health issues. Many toxics are suspected to cause cancer, reproductive problems, decreased immune system function, respiratory issues, or even birth defects. Some examples of air toxics are dioxin, from the open burning of trash; asbestos, found in older homes; benzene, found in gasoline; perchlorethlyene, emitted from dry cleaners; and methylene chloride, a solvent and paint stripper. Other air toxics include metals such as cadmium, mercury, chromium, and lead compounds. All of these substances are considered hazardous to humans and are regulated by the EPA.

Humans can come in contact with air toxics a few different ways. One way is to breathe in the toxins. Many times we do not know we are breathing in polluted air and will not notice any effects for some time. Another way humans come into contact with air toxics is from chemicals such as mercury in the air depositing on our water or land. Plants and animals take in these pollutants through the soil and water. The toxics then accumulate in the plants' and animals' bodies until humans eat them. Then the toxics are transferred to our bodies and begin to accumulate. The more contaminated food we eat and water we drink, the more toxics accumulate in our bodies. This is called bioaccumulation. Many times we will not notice any effects of the chemicals in our bodies until the concentrations build.

So how do we find air quality information?

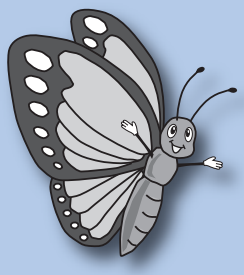
Visit the DNR's Air Management web site at dnr.wi.gov/air. There you can find information on pollutants, sources of pollution, and health effects. While visiting the site, you can also learn if an Air Quality Advisory (AQA) has been called. Air Quality Advisories were created to let the public know when pollution levels are unhealthy. An Air Quality Advisory is called when air pollution levels have reached or exceeded set standards. Let your school nurses, physical education teachers, and coaches know if an AQA has been called. Students who are sensitive to air pollution should take it easy outdoors on these days.

So what can we do about air pollution?

- **Teach, teach, teach!** Get the word out about how important good air quality is and how to find out the quality of the air in your area. The younger children learn about the importance of keeping our air clean the better chance they have at being part of the solution, instead of the problem.
- **Encourage even the smallest of efforts!** It all adds up! Even tiny efforts can really add up to a large change. Remind yourself and your students that they can be the difference in keeping our air clean.
- **Implement school-wide projects** like waste-free lunches, idle-free school zones, or start a student energy patrol program
- **Visit Wisconsin DNR's "Do A Little, Save A Lot" web pages** to learn how you can reduce your personal emissions at home, at work, and while traveling to help keep our air clean.

Where's the Air?

ACTIVITY 1



Learning Objectives:

- Demonstrate that air exists all around us.
- Describe physical characteristics of air.

Subjects

- Science
- Language Arts

Materials

- Where's the Air? student worksheet

Teacher's Background Information

Since you cannot usually see air, it can be a difficult concept to understand, especially for children. The goal of this activity to provide evidence that air exists all around them. While doing the exercise, have students write down their observations and answer the questions on the worksheet. They will use this information to help write a poem or riddle that describes air to others. It might be helpful to go through a practice exercise with the students on how to write a riddle. Visit *www.readwritethink.org* for help and instructions on how to write your own riddle.

We welcome your students' poems and riddles. We'll post some of the submittals on EEK!, Environmental Education for Kids, our kids web pages. Submit them to:

Wisconsin DNR
Air Education—AM/7
P.O. Box 7921
101 S. Webster St.
Madison, WI 53707-7921

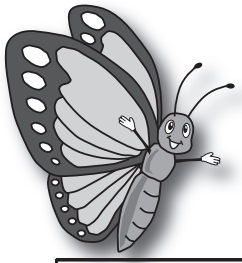
email: *DNRAirEducation@wisconsin.gov*

Remember:

- Teachers, please remember to post or make available the **bold-faced** vocabulary word definitions in each activity *(see the glossary on page 65 for definitions).*

Name_____ Date_____

Where's the Air?



Air isn't always the easiest thing to see, hear, touch, smell, or taste. Sometimes we have to do a little detective work to even know it's there.

Can you *see* it?

Look outside at a flag, leaves on a tree, or a lake or river. Describe what you see. How can you tell there is air by using your eyes?

Can you *feel* it?

Open you palm and move your hand back and forth near your face. Describe what you feel.

Can you *hear* it?

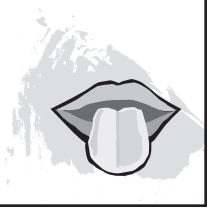
Go outside (or stay inside), close your eyes and listen. Describe what you hear. How can you tell there is air by using your ears?

Can you *smell* it?

Close your mouth and take a deep breath through your nose. Describe what you smell. You may smell something, you may not. Air itself does not have an obvious smell; **air hitchhikers** (or air pollution) may, however. Keep in mind if you can smell something, you are also breathing it into your body.

Can you *taste* it?

Hold your tongue out and try and taste the air around you. Describe what you taste. You may taste something, you may not. Air itself does not have an obvious taste; hitchhikers in the air may, however.



Name_____ Date_____

Questions:

1. By doing this experiment, what proof do you have that air is around you?

2. What words or phrases can you use to describe air?

3. What does the world need air for?

4. What would the world be like without air?

Now try writing a simple poem or riddle to describe air without using the word "air." (See the example in the box) Read it to a parent or friend and see if they can figure out what you're describing. It's kind of like playing a guessing game with words.

Example:

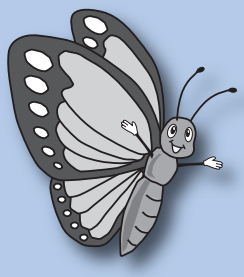
Wisconsin Forest Animal

Its tail so soft and bushy
Its antlers so fierce and
such a beauty to see,
Its eyes so sharp,
Its legs so strong,
Its fur so soft,
Its hoofs so tough,
It runs so swift.
What is it?

Answer: a deer

Air Soup

ACTIVITY 2



Learning Objectives:

- Demonstrate the composition of air.
- Introduce the concept of percentages.

Subjects

- Math
- Science

Materials

- Bowl
- Spoon
- Different ingredients for each gas
  (You can use different colored beans, crackers, cereal, candy, paper balls, marbles, etc. Just make sure you have 78 "Nitrogens," 21 "oxygens," 1 "argon," etc.)
- Air Soup student worksheet

Teacher's Background Information

Your students may think about air as oxygen, the gas that they breathe to live. In this activity, students will learn there is more to air than just oxygen. Air is a "soup" made up of different ingredients, each important and necessary to the recipe.

Explain to the students that there are only 11 elemental gases (hydrogen, helium, nitrogen, oxygen, fluorine, neon, chlorine, argon, krypton, xenon, and radon), but when mixed together those 11 gases can create endless compounds. Sort of like phone numbers; there are only 10 digits that can be used for phone numbers (0, 1, 2, 3, 4, 5, 6, 7, 8, 9), but when all mixed up, create many, many different phone numbers. (Then add area codes to the phone numbers and you get even more combinations.)

Air is composed of the following gases:

Nitrogen	(N_2)	78%
Oxygen	(O_2)	21%
Argon	(Ar)	0.9%
Carbon Dioxide	(CO_2)	0.033%
All other gases combined		0.067%

Nitrogen is a colorless, odorless, tasteless, inert gas. All plants and animals need nitrogen to live. Although nitrogen makes up 78% of the air we breathe, most of it is in a form we can't use (N_2). Before plants and animals can use the nitrogen in the air it has to be converted into forms that plants and animals can use like nitrates (NO_3), nitrites (NO_2), and ammonia (NH_4). This is done by nitrogen-fixing bacteria. These bacteria take the nitrogen (N_2) out of the air and convert it to NO_3, NO_2, and NH_4. Plants then take up these new forms of nitrogen from the soil. Animals, including humans then get most of the nitrogen they need to live from the plants they eat. Our bodies use the nitrogen from the food we eat to make proteins, DNA, and RNA – the building blocks of life

Oxygen is the gas that we all need to live: though we do not breathe pure oxygen when we breathe in air. Oxygen is a very reactive gas and will react to just about any element or compound. The free O_2 in our atmosphere comes from green plants – one of the byproducts of photosynthesis.

Argon is an odorless, colorless, and nonreactive gas. In fact argon is considered non-toxic. Argon is so nonreactive it is used in light bulbs to surround the filament. It seems that argon is such a small component of air, but it is still the 3rd largest "ingredient" in "air soup."

Carbon Dioxide is a compound made of one carbon atom and two oxygen atoms. Animals breathe out CO_2 all day long. Luckily, we have plants that use CO_2 in the photosynthesis process. Plants use CO_2 to create their own "food." As we learned before, they then give back oxygen for animals to breathe.

Make sure you give the students the Ingredient Key. For instance, if you are using "soup ingredients" you could write the ingredients key as this:

Ingredient Key

N_2	=	macaroni noodle
O_2	=	pea (dried)
Ar	=	barley
CO_2	=	lentil
Other	=	rice

You can use any ingredients such as candy, crackers, cereal, paper balls, marbles, etc. Just make sure you have enough of each "ingredient" for each student or for one bowl if you do this as a class activity. For ingredients like CO_2 or other gases you may want to supply small pieces if the main ingredient you choose cannot be broken apart.

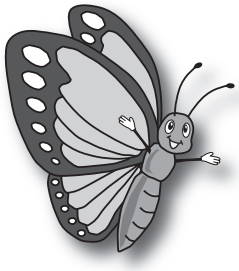
This activity can be extended with a graphing component.

Remember:

- Teachers, please remember to post or make available the **bold-faced** vocabulary word definitions in each activity *(see the glossary on page 65 for definitions).*

Name _____ Date _____

Air Soup



Think about your favorite soup. Soup has a whole list of ingredients. Can you list some of the ingredients in your favorite soup?

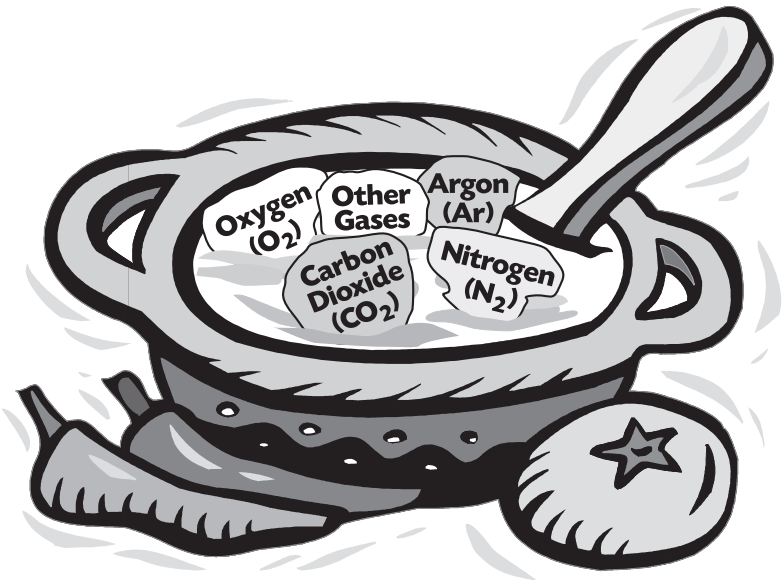
_____

_____

_____

_____

Air is like soup, it has lots of different ingredients too!



Let's make our own soup!

Use the recipe below to make your air soup. Have your teacher give you the ingredient key. Make sure to measure out the correct amount of each ingredient. Are you ready? OK, let's prep our kitchens. You'll need a bowl, a spoon, and a supply of all of your ingredients listed below. Add all your ingredients to the bowl and don't forget to mix your soup!

Ingredients:	Amount:
N_2	78 pieces
O_2	21 pieces
Ar	1 piece
CO_2	tiny crumb of a piece
Other Gases	half of one piece

Ingredient Key:		
N_2	=	_____
O_2	=	_____
Ar	=	_____
CO_2	=	_____
Other Gases	=	_____

Name _____ Date _____

Questions:

1. Now what do you notice about your soup?

2. What is there a lot of? _____

3. What is there a little of? _____

4. If you add up all the pieces how much do they equal? _____

5. About what percentage (%) of air is made up of:

Nitrogen _____

Oxygen _____

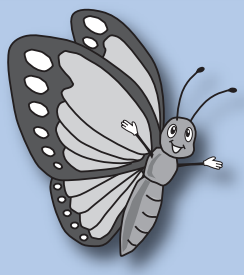
Argon _____

5. What would happen if we took out one of the ingredients? Would we have the same air? Which ingredients do you think are most important to plants and animals, including people?

Hint: All animals including people need oxygen (O_2) to live! And all plants need carbon dioxide (CO_2) to survive! Nitrogen is also really important to both plants and animals.

The Weight of Air

ACTIVITY 3



Learning Objectives:

- Visually demonstrate that air has weight and takes up space.

Subjects

- Science
- Math

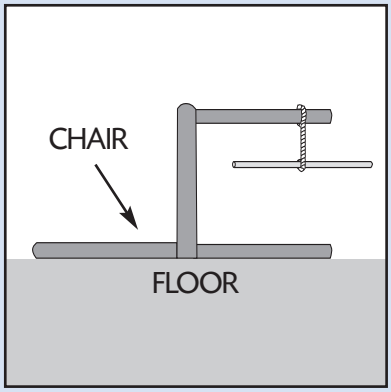
Materials

- Wood dowel (about 15 inches)
- 3 pieces of string (6 to 7 inches long)
- 2 balloons
- Pin (or a pair of scissors)
- The Weight of Air student worksheet

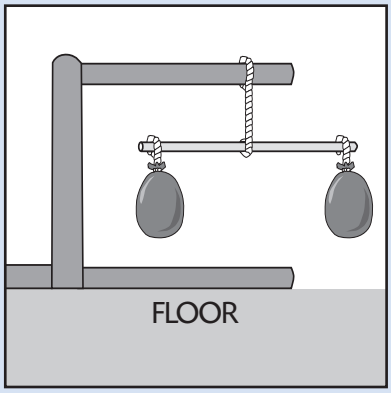
Teacher's Background Information

NOTE: If students have not completed activities Where's the Air? or Air Soup, the teacher may want to explain how we can feel air and what air is made up of.

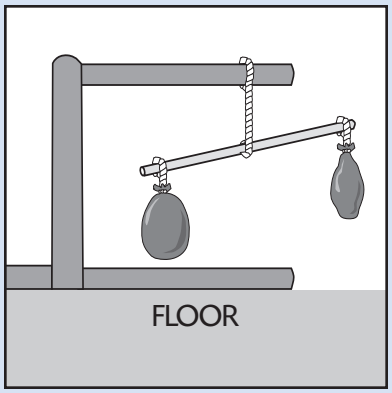
If you think the students can think up their own experiment given the materials above, let them design their own experiment. If not, you may want to provide them with the following instructions to create their own balance scale with a wooden dowel and some balloons filled with air.



Tie one string tightly to the middle of the dowel. Using the other end of the string, hang up the dowel from a chair or something else in the room so that it is hanging freely. Slide the string along the dowel until it is balanced.



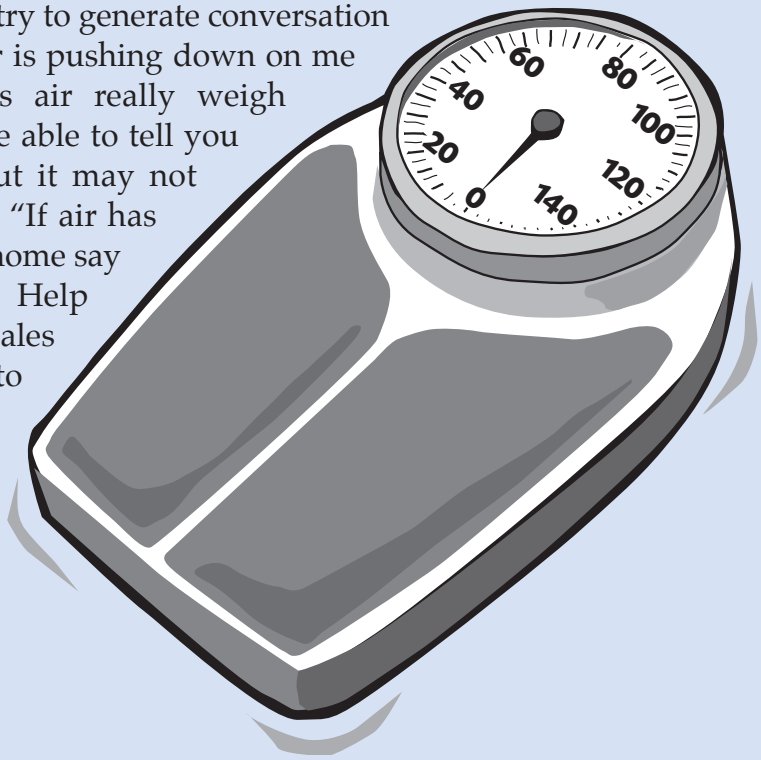
Blow up a balloon and tie it shut. Tie the balloon tightly with the second piece of string. Do the same with the other balloon and piece of string. Tie one balloon to one end of the balancing dowel and the other balloon to the other side of the dowel. Slide the strings back and forth until they are balanced.



Now, let the air out of one of the balloons by carefully puncturing it with a pin near the tie on the balloon. (The balloon should not burst! Allow the air to seep out.) If the pin hole is not large enough, puncture it a few more times so the air starts to leak or try putting a very tiny slit near the tie of the balloon with a pair of scissors.

Remind students that both of the balloons balancing on the dowel have air inside of them. After puncturing one balloon, have the students observe what happens. The air rushes out of the balloon making the dowel off balance. The balloon still filled with air sinks and shows the students that it weighs more – air has weight.

Once this conclusion is found, try to generate conversation by asking, "I don't feel like air is pushing down on me when I stand here. So does air really weigh anything?" Students should be able to tell you that air does have weight, but it may not weigh a lot. You can also ask, "If air has weight, why does my scale at home say zero before I step on it?" Help students to understand that scales can be calibrated and adjusted to weigh only your weight or the weight of the object that is placed on it, not the weight of the air that rests on it.

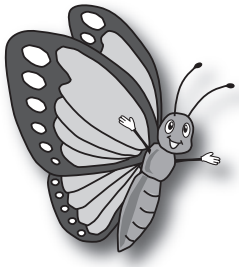


Remember:

- Teachers, please remember to post or make available the **bold-faced** vocabulary word definitions in each activity *(see the glossary on page 65 for definitions).*

Name_____ Date_____

The Weight of Air



Now we know air is made up of a bunch of different gases like **oxygen** and **nitrogen** and we can actually feel air, but does it weigh anything?

Ok, here is your mission…

- Answer the question – *Does air have weight?*
- Use some or all the materials listed in the box to design an experiment to test if air has weight.

Materials:

- 2 balloons
- 3 pieces of string
- Wooden dowel
- Pin or scissors

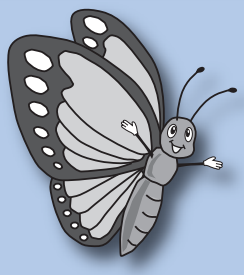
Experiment Questions:

1. Describe the experiment you came up with.

2. What was the result, does air have weight? How do you know?

Does Clear Air = Clean Air?

ACTIVITY 4



Learning Objectives:

- Demonstrate how human actions impact the air around us.
- Identify pollutants created by different human actions.

Subject

- Science

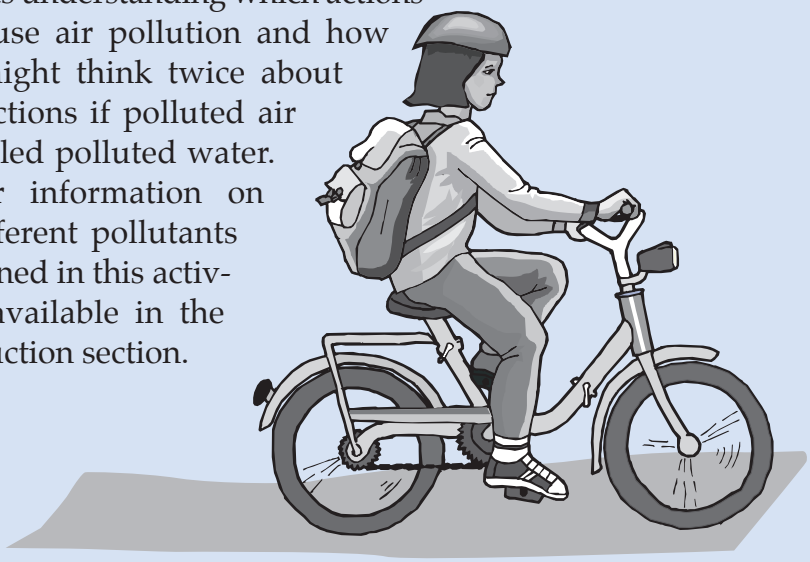
Materials

- One clear glass or plastic cup
- Water
- Mixture ingredients (see example on next page)
- Spoon
- Does Clear Air = Clean Air? student worksheet

Teacher's Background Information

Air pollution is sometimes a difficult topic to grasp because many times it is not visible. The goal of this activity is to help students understand that just because they might not be able to see air pollution does not mean it is not there. Prior to starting the activity you may want to have a brief discussion about air pollution and its causes. You may even want to determine the major source of energy for your area (coal, oil, natural gas, etc.). About 75 percent of Wisconsin's electric energy comes from coal, oil, and natural gas.

After the initial discussion on air pollution, have the students make a list of all the ways they use energy from the time they wake up to the time they get to school. Then have them fill out the Student Checklist based on their actions. The focus of the activity should not be on the specific type of pollutants (CO, CO_2, etc.) produced, but rather on the students understanding which actions can cause air pollution and how they might think twice about their actions if polluted air resembled polluted water. Further information on the different pollutants mentioned in this activity is available in the Introduction section.



Does Clear Air = Clean Air?

Prior to starting the activity, assign a mixture ingredient for each pollutant listed in the Pollutant Table and share the ingredient list with your students. You can use whatever you have readily available. It is fun to use things that when combined create a very visually interesting result. Here's an example:

Pollutant:	Mixture Ingredient:
CO	Chocolate syrup
CO_2	Vegetable oil
Particle Pollution	Coffee grounds
NOx	Drink mix powder
SO_2	Dark colored soda
VOCs	Honey
Toxins	Ketchup

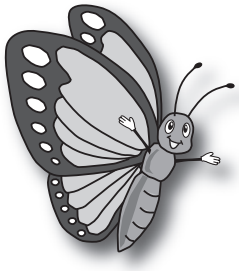
Now have the students add all the pollutants they produced to their cup of water. Discuss the Follow Up Questions as a group or have the students answer them independently.

Remember:

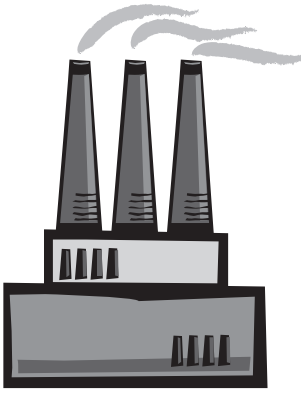
- Teachers, please remember to post or make available the **bold-faced** vocabulary word definitions in each activity *(see the glossary on page 65 for definitions).*

Name _____ Date _____

Does Clear Air = Clean Air?



How can you tell when the air outside is clean or dirty? Although there are days where you can actually see dirty air, most of the time we cannot tell by looking outside whether our air is clean or dirty. When harmful amounts of gases, dust, or fumes are released into the air it's called **air pollution**.



So where does air pollution come from? Unfortunately, most of the time humans are the main cause of air pollution. When we use any kind of electrical gadget (like a hairdryer, microwave, toaster, computer, or cell phone) the energy needed to make it work comes from a **power plant** to our house. Most of the power plants in Wisconsin use coal, oil, or natural gas to produce electricity. Producing electricity can cause quite a bit of air pollution. The more energy we use, the more the power plant has to produce and the more air pollution is created.

Electrical items are not the only things that create air pollution – things like lawn mowers, cars and trucks, leaf blowers, boats, and other fuel-powered tools also cause air pollution. Even certain paints and household cleaners create air pollution.

Now let's take a look at how your everyday actions might impact the air quality around you.

Make a list of ways you use energy each day. Start a list from the time you wake up in the morning until the time you get to school.

Hint: Think about all the things you would not be able to do or you would miss if the power went out. Also think about other actions that use gasoline or other fuel.

My Morning Energy List:

_____

_____

_____

_____

_____

_____

_____

_____

_____

Name_____ Date_____

Now, look at your Morning Energy List and add the correct number of checkmarks under the Student Check List column for each category listed below. You can also add in extra actions you might have come up with in the extra spaces provided.

Actions	Some Resulting Pollutants	Student Check List
Transportation ■ Car or truck ride to school today – add two checkmarks ■ Bus or carpooled – add only one checkmark ■ Walked, biked, or skateboarded today – NO checkmarks . You produced NO air pollution!	Carbon Dioxide (CO_2) Carbon Monoxide (CO) Nitrogen Oxides (NOx)	
Electricity Use (Hair dryer, microwave, garage door, cell phone, radio, lights, computer, air conditioning, etc.) ■ Add one checkmark for every item you used.	Carbon Dioxide (CO_2) Carbon Monoxide (CO) Nitrogen Oxides (NOx) Particle Pollution Sulfur Dioxide (SO_2) Volatile Organic Compounds (VOCs)	
Other Gas Powered Engines (Lawn mower, snow blower, boat, leaf blower, trimmer, etc.) ■ Add one checkmark for every item you used.	Carbon Dioxide (CO_2) Carbon Monoxide (CO) Nitrogen Oxides (NOx)	
Open Burning (A fire in the fireplace or burned trash or yard waste outside.) ■ Add one checkmark if someone at your house open burned.	Particle Pollution Toxins	

Name_____ Date_____

What in the world are **carbon monoxide**, **carbon dioxide**, **sulfur dioxide**, **nitrogen oxide**, **particle pollution**, **VOCs**, and **toxins**? I know it's a mouthful! These are all different pollutants that when released into the environment in large quantities can be harmful not only to the natural world around us, but to humans too! All of these pollutants are usually released into the environment as gases except for particle pollution, which is made up of very, very small particles (like soot from a fire) that can get trapped in our lungs.

The problem with air pollution is that a lot of times you cannot see it, so we are going to do a quick activity to help you think about what you might do if you could actually see the pollutants in the air…

Activity

1. Get a clear cup or glass and fill it about halfway with water.

2. Fill in the Pollutant Table below. (Ask your teacher for a list of ingredients.)

Pollutant:	Mixture Ingredient:
CO	
CO_2	
NOx	
Particle Pollution	
SO_2	
Toxins	
VOCs	

3. Using your Student Checklist and the Pollutant Table add the ingredients that were produced by your actions to your cup of water. After adding your ingredients, make sure you stir it up really well!

4. Answer the Follow Up Questions on the next page.

Name_____ Date_____

Follow Up Questions:

1. What does your cup look like?

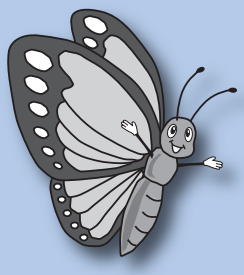
2 Can you tell what pollutants came from what actions?

3. If air pollution was this easy to see would you want to breathe the air?

4. Now revisit your activities for the day. What could you do differently to reduce the amount of pollution you released?

Clean Air – How Far We've Come

5



Learning Objectives:

- Discover how air quality and citizen awareness of air quality has changed over the years.
- Identify key events that have led to understanding and citizen action related to air quality.

Subjects

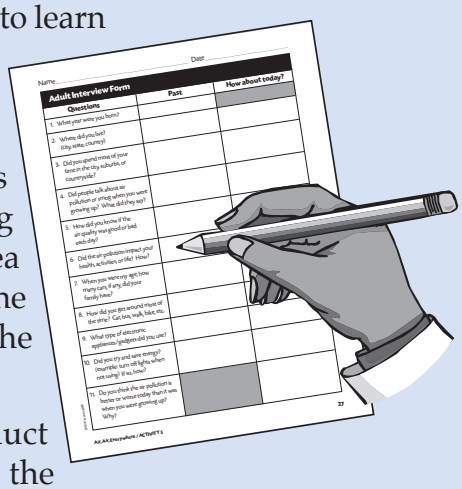
- Social Studies
- Language Arts
- Science

Materials

- Adult Interview Form
- Student Form
- Air Quality Event Cards
- Crayons/markers/colored pencils
- Butcher block paper
- Magazines
- Scissors
- Glue

Teacher's Background Information

Part 1



The goal of Part 1 is for the students to learn first hand through interviews what people's perceptions of air quality were when they were growing up and how (or if) those perceptions have changed today. By interviewing others, students will get a better idea of what the air quality was like in the past and how it has changed for the better or worse.

Prior to having students conduct interviews, you may want to ask the students some questions regarding air pollution sources and solutions so they have a better idea of how the questions relate to air quality. Go through the interview questions together before sending the students out to conduct their interview.

1. **What are the main sources of air pollution?** Burning of fuels such as coal, oil, gas, and wood that we use to run our cars, trucks, factories, and power plants.

   About 75 percent of Wisconsin's electric energy comes from the following: coal (65 percent), oil (1.4 percent), and natural gas (8.7 percent).

2. **How do your actions impact the air quality around you?** Explain that it's likely that most of the energy produced to run all the electric gadgets that make our lives easier (such as lights, furnaces, air conditioners, TVs, refrigerators, and computers) likely comes from a power plant that burns fuel like coal. Therefore, when we use energy we are requiring the power plants to burn more fuel, which produces more air pollution.

   Driving cars/trucks burns gasoline which also is a large source of air pollution.

3. **What are some things we can do to reduce air pollution?**

   — use less energy at home when possible

   — turn off lights

   — bike or walk whenever possible rather than drive

   — carpool when possible

   — turn our thermostats down in winter and wear more layers

   — take the bus

   — close your shades in summer to keep the house cooler

If this is the first time your students have ever conducted an interview you may want to review simple interview etiquette with them.

Follow Up Discussion

Using the students' interview summaries, have a discussion on how people's perceptions about air quality and their actions have changed, if at all. Some questions to consider:

1. Did the location the person lived in have an impact on their answers?
2. What impact has technology had on air quality?
3. Does it seem like people are more concerned with air quality now or in the past. Why?
4. Do people think that the air quality is better or worse now than in the past?
5. Are people taking action to reduce air pollution?
6. What, if anything, can we learn from the past that will help us have cleaner air to breathe in the future?

Part 2

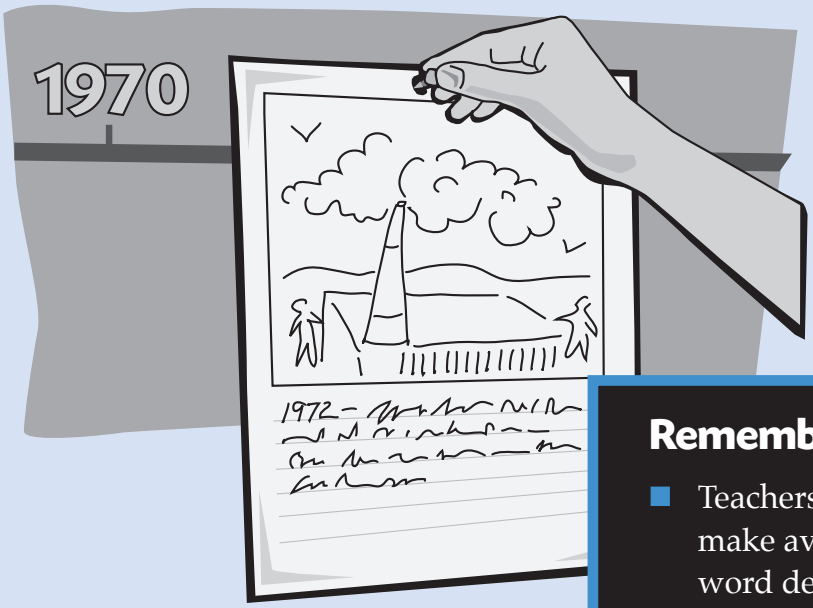
The goal of Part 2 is for students to learn about events in the past that have increased our understanding about air quality and have impacted our overall air quality today.

For this activity, pass out an **Air Quality Event Card** to each student or pair of students. Have the students read the details of their event and create a picture/collage describing the event along with a short description. Include some information/events from the interviews, if possible, as well as some of the fun facts provided.

As a class, create an **Air Quality Timeline** to post either in the classroom or another area of the school where others can view it. Have the students report on their event as they are posting their picture and description.

After everyone has posted their event, have a discussion about how these events have impacted our air quality and our understanding of air quality today.

1. Which event(s) were most shocking to you, why?
2. Did you see any common threads throughout the timeline, if so what were they?
3. What can we learn from these events that will help us make better decisions for our health and our environment in the future?

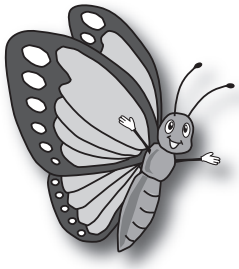


Remember:

- Teachers, please remember to post or make available the **bold-faced** vocabulary word definitions in each activity *(see the glossary on page 65 for definitions).*

Name_____ Date_____

Clean Air – How Far We've Come



Air quality has changed a lot over the past 100 years. **Air pollution** makes the air dirty, sometimes a little and sometimes a lot. Depending on where you live, the air quality may have gotten better or worse. New air quality laws, new and better ways to measure and clean our air, and changes in the way we live our lives have all had a huge impact in reducing air pollution and cleaning the air we breathe every day.

Activity

Part 1 – The Interview

To learn more about how air quality has changed over time, use the Adult Interview Form on the next page to **interview** an older adult about what they remember about air pollution as they were growing up. Ask them to answer the questions based on what they remember growing up (write those answers in the "Past" column) and also ask them how they would answer the questions today (write those answers in the "How about today?" column). Interview someone like a grandparent or older neighbor (try to find someone who was born before 1945).

Name of person you interviewed:

_____

How do you know them?

_____

* Don't forget to thank your interviewee!

Name_____ Date_____

Adult Interview Form

Questions	Past	How about today?
1. What year were you born?		
2. Where did you live? (city, state, country)		
3. Did you spend most of your time in the city, suburbs, or countryside?		
4. Did people talk about air pollution or smog when you were growing up? What did they say?		
5. How did you know if the air quality was good or bad each day?		
6. Did the air pollution impact your health, activities, or life? How?		
7. When you were my age, how many cars, if any, did your family have?		
8. How did you get around most of the time? Car, bus, walk, bike, etc.		
9. What type of electronic appliances/gadgets did you use?		
10. Did you try and save energy? (example: turn off lights when not using) If so, how?		
11. Do you think the air pollution is better or worse today than it was when you were growing up? Why?		

Name_____ Date_____

Now, use the form below and answer the questions yourself.

Student Form

Questions	Answers
1. What year were you born?	
2. Where do you live? (city, state, country)	
3. Do you spend most of your time in the city, suburbs, or countryside?	
4. Did people around you talk about air pollution What do they say?	
5. How do you know if the air quality is good or bad each day?	
6. Does the air pollution impact your health, activities, or life? How?	
7. How many cars, if any, does your family have?	
8. How do you get around most of the time? Car, bus, walk, bike, etc.	
9. What type of electronic appliances/gadgets do you use?	
10. Do you try and save energy? (example: turn off lights when not using) If so, how?	

Name_____ Date_____

Summary:

Compare your answers with the answers of the person you interviewed. Write a summary explaining how people's views about air quality have changed throughout the years. Did the area the person lived in seem to make a difference in their answers? Can we learn anything from the past that will help us have clean safe air to breathe in the future? Explain.

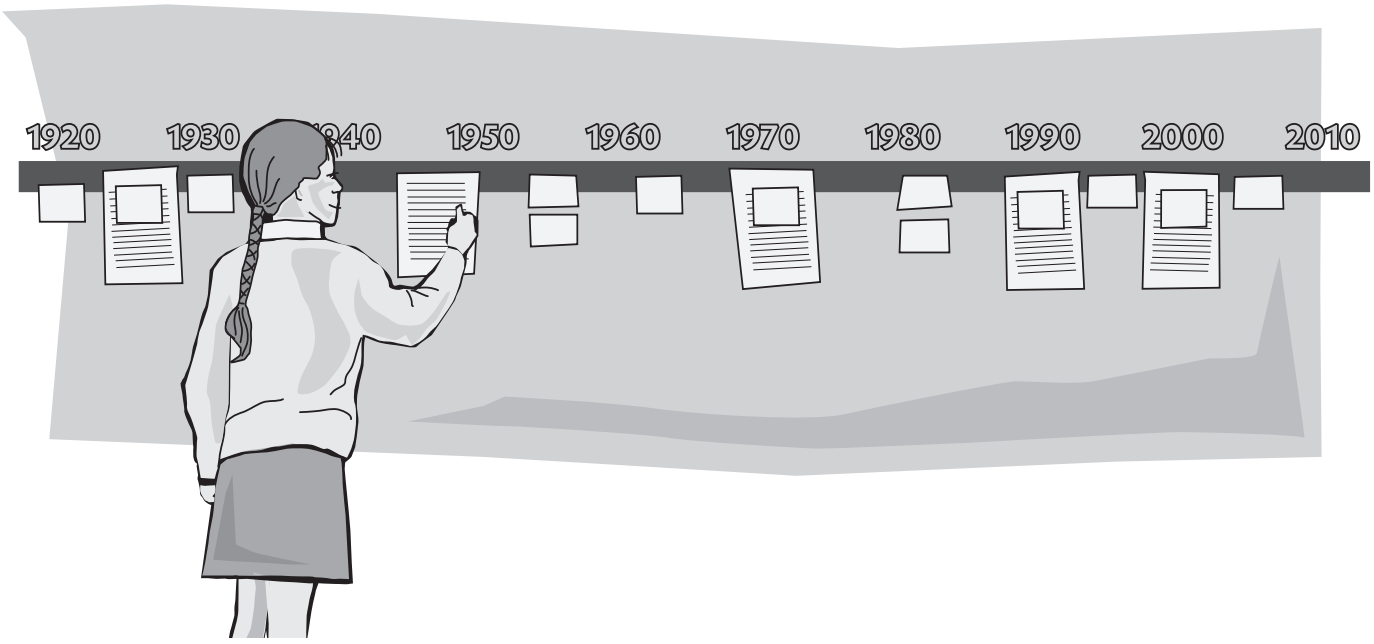
Name_____ Date_____

Activity

Part 2 – Air Quality Events Timeline

As a class, create a picture timeline using events shown on the Air Quality Events Cards. Most of these events have either changed the air quality around us or given us information to make better decisions for the environment and our health (okay, so we added some non-air fun facts too).

- Include the year you were born, the year your school was built, and some interesting facts/stories from your interview on your timeline too.
- For each event include a picture that describes the event along with a short explanation.
- Share the timeline with someone else or post a class timeline somewhere in your school so everyone can learn from it.



Air Quality Events Cards

1922 Lead added to gasolline

Lead was added to gasoline to help car engines run better. But when cars burned gasoline to run they released a lot of lead into the air.

People then breathed that air into their bodies which caused big health problems, especially in young children – YIKES!

1930s Legos were first designed in Europe

You know those fun-colored building blocks that stick together? Can you believe that they were created over 80 years ago in Denmark?

Some toys never get old.

1948 Donora Disaster

On the evening of October 16th a zinc company released a cloud of very harmful dust and gas into the air in Donora, Pennsylvania (a town just south of Pittsburgh).

Twenty people died and 7,000 people had to be brought to the hospital because they couldn't breathe.

1967 Green Bay Packers win SuperBowl I

Against the Kansas City Chiefs at Los Angeles Memorial Coliseum, the Green Bay Packers win SuperBowl I.

Score 35 – 10.

GO PACKERS!

Air Quality Events Cards

1968 First "whole globe" picture of the Earth

Astronauts of the Apollo 8 space mission to the moon took the first pictures of the whole earth from space.

It was the first picture many people ever saw of our Earth and it helped them understand that we all need to take care of our beautiful world.

1970 First Earth Day

Wisconsin's U.S. Senator Gaylord Nelson helped organize the first Earth Day on April 22nd, 1970.

People from all over the country organized and took part in events that helped teach people about the environment.

Events like this really helped to get people thinking about how their actions might harm the environment.

1970 The Environment Protection Agency (EPA) was created

EPA was created to protect human health and the natural environment (air, water, and land) that all living things need to live.

One of the first jobs given to EPA was to protect the public's health from air pollution – the Clean Air Act gave them that job the same year EPA was created.

1970 Clean Air Act was signed

Our government passed the **Clean Air Act** which helped create laws to make our air cleaner and healthier to breathe.

The laws passed as part of the Clean Air Act limited the amount of harmful air pollutants from industries and protected people's health and the environment.

Imagine how dirty our air would be today if everyone could just put all kinds of harmful things into the air – YUCK!

Air Quality Events Cards

1973 Environmental Protection Agency (EPA) starts to take lead out of gasoline

The EPA started to require oil companies to remove **lead** from gasoline used by cars and trucks.

It actually took a long time before all the lead was removed. This didn't happen until 1996, but as the amount of lead in gasoline got lower so did the amount of lead in the air that was causing health problems –YIPPEE!

1987 Airplanes started monitoring air quality around Lake Michigan

So what is an air quality monitor? An air quality monitor measures the amount of pollutants in the air. Airplanes were used to monitor ozone, a gas that is harmful close to Earth. Measuring these pollutants is important because if there is too much pollution in the air, some people will have a hard time breathing and could start to have other health problems.

The airplanes could fly over large areas and find out where some of the pollution was coming from. Scientists learned that air pollution could travel hundreds and even thousands of miles.

1992 Wisconsin starts biomonitoring program

So what is biomonitoring anyway?

Biomonitoring is using plants, animals, or entire ecosystems to tell if our environment is polluted. Scientists looked for special spots on white pine trees and **milkweed** plants to know if there were high levels of an air pollutant called **ozone** where the plants grew.

Plants can show a historical record of an area, including the history of the air! Machines that measure air quality show just a snap shot of time.

1994 Lead in blood drops

The amount of **lead** in the blood of American kids (1–5 years old) dropped by more than 75% between 1976–1994. That's a lot!

The laws created as part of the **Clean Air Act** helped make this happen. This meant that fewer kids that had health problems from lead in the air they were breathing.

GO CLEAN AIR ACT!

Air Quality Events Cards

1995 Ozone monitor on Badger Ferry

An **ozone** monitor was installed on the Badger Boat Ferry that carries people and cars across Lake Michigan between Manitowoc, WI, and Ludington, MI, to track where air pollution was traveling.

So what is an ozone monitor? It's a piece of equipment that measures the amount of ozone in the air. Ozone is something that's formed in the air when a mix of pollutants bake in the sun.

Too much ozone in the air can cause breathing and other health problems. It's important to measure how much is in the air to warn people sensitive to ozone.

1995 Ozone Action Days in Wisconsin

Ozone is formed in the air when a mixture of pollutants bake in the sun. Too much ozone can make it hard to breathe and cause other health problems.

In 1994, our neighboring state Michigan started warning people when scientists predicted harmful levels of ozone and asking them to cut back on polluting activities (like driving cars) to keep the air clean. They named these days Ozone Action Days. In 1995, all four states surrounding Lake Michigan (can you name these states?) began identifying Ozone Action Days.

1999 Environmental Protection Agency (EPA) created the Air Quality Index (AQI)

The **AQI** is a tool to tell people how good or bad the air quality is every day. When the air is good or ok you'll see a green or yellow color, but when the air quality is poor and can be harmful to your health you'll see an orange or red color.

Check out http://airnow.gov to find out the air quality where you live.

1999 Dora the Explorer TV show

Dora the Explorer TV show started this year.

Even today, you can find pictures of Dora, Boots, and Diego on everything from coloring books to pajamas.

"Dora, Dora, Dora, the Explorer…"

Air Quality Events Cards

2001 Lake Michigan air cameras

Many types of air pollution are invisible but some can be seen with the naked eye. Haze occurs when air pollutants hang in the air, and it reduces our ability to see far away buildings or shorelines. Haze looks a little bit like fog but it typically occurs during drier weather and is mostly a problem near cities. Haze cameras were put up in the states surrounding Lake Michigan to measure air quality.

2001 iPod is brand new

The Apple Company created a new easy-to-use gadget to play and listen to music.

2006 Wisconsin Air Quality Advisories

Since we can have air pollution problems not just from **ozone**, a gas, but also from tiny particles in the air called **particle pollution**, Wisconsin began using **Air Quality Advisories**, which can be triggered by either kind of pollution.

The new system is a little like the tornado warning system and was developed by the National Weather Service. When the air pollution levels become too high to be healthy, they issue an Air Quality Advisory to tell people to protect their health – like staying inside or not doing really active exercise outdoors.

2008 Summer Olympics in Beijing, China

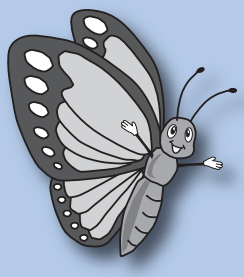
USA won 110 medals, more than any other country! But these Olympics were good for another reason – they pushed China to look harder at their air quality problems.

To make the air in Beijing cleaner for athletes and visitors during the Olympics, car and truck traffic was limited, polluting construction was stopped, and less coal was burned.

These techniques worked so well that the city decided to continue some of them even after the Olympics ended.

The Clean Air Act

ACTIVITY 6



Learning Objectives:

- Introduce the Clean Air Act and understand its purpose.
- Demonstrate how both ozone and particle pollution form.

Subjects

- Science
- Social Studies

Materials

- The Clean Air Act student worksheet
- Open space outside or room with space to move around

Teacher's Background Information

NOTE: If students have not completed activities Where's the Air? or Air Soup, the teacher may want to explain how we can feel air and what air is made up of.

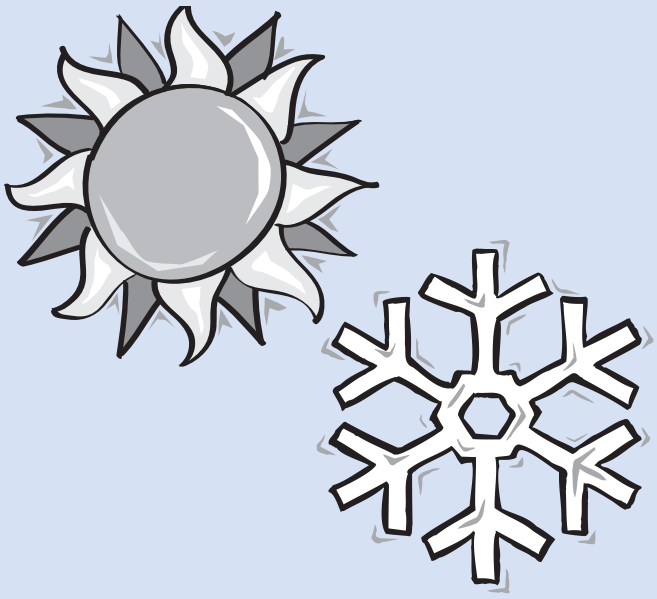
Students should understand the basic structure of our government. Remind students that people in this country vote for legislators to represent them. Ask the students if they know any of their legislators from the House of Representatives or Senate. The House and Senate work together as Congress to create new laws – such as the Clean Air Act.

The Clean Air Act was created in 1970 to help regulate pollution in our air and the sources of that pollution. There are two main categories of pollutants – criteria pollutants and air toxics. Criteria air pollutants (ozone, particulates, carbon monoxide, nitrogen oxides, sulfur dioxide, and lead) are the most common air pollutants and what the EPA uses to determine air quality standards. Air toxics are less common pollutants, but still very important. Many volatile organic compounds (VOCs) are identified and regulated as air toxics. Toxics can be very harmful to human health. They can cause a range of health effects and some, like mercury, can bioaccumulate up the food chain – the chemicals can stay in the organism for long periods of time and when the plant or animal is eaten, all of the chemicals inside of it enter and remain inside the new organism, increasing the concentration of the pollutants in organisms.

Teachers, review the Introduction section for more detailed information on air pollutants.

Ozone is formed when VOCs and NOx, react in the presence of sunlight and heat; therefore, ozone in Wisconsin is a problem only in the warm summer months.

Particle Pollution can be made up of many different kinds of substances, including dust, water vapor, chemical compounds, even fragments of pollen or mold spores in the air. Particles can form any time of the year; often they are at their highest in coldest months because temperature inversions (colder air above traps warmer air below when winds are calm) hold the pollution close to the ground!



Student Worksheet Answers

Ozone:

1. What do you need to create ozone? Circle the correct answers below.

candy (sunlight) basketball rainy skies (VOCs) backpack (NOx) (heat)

2. Now that you know what you need to create ozone, list a few places that VOCs and NOx come from.

flip flops (cars) (buses) (factories) (paint) (lawnmower) bike (marker)

Particle Pollution:

1. Particle Pollution can be made up of many of different pollutants. Circle the things that might be part of particle pollution.

(water vapor) crayons (allergen) soccer ball (smoke) camera (dust)

2. Where do these particles come from? Circle the answers below.

(dusty road) (tailpipe) toothbrush (fire) pinwheels (factories) bird

Now let's act out how ozone forms. First, what do you need to create ozone? Fill in the spaces below.

sunlight	heat
VOCs	NOx

Now, let's make some ozone! Find an open space that has enough room for the students to stand up and move around in. Do this outside if you can! Pick one student to be the sun. Pick one other student to be heat. Now, divide the rest of the class up into ozone "parts." Label some of the kids "oxygen" and put one "oxygen" in each small group with one or two other kids to make "VOC" groups and "NOx" groups. Have the kids act out "winter" (the pollutants float around in the air while the sun is out, but there is no heat). Now ask students to act out "summer" (the sun is out, the pollution is floating around, and there is heat). Remind students that in the presence of sunlight and heat the oxygens will break apart from their "groups" and find other oxygen atoms to attach to. One molecule of ozone is 3 oxygen atoms bonded together. For fun, have the students act out a "summer with no pollution" scenario. There is heat and there is sunlight, but if there is no VOC and NOx, we cannot make ozone. Help students understand that we cannot change the temperature outside; therefore, the best way to reduce ozone formation is to keep our air clean and pollution free.

Student Worksheet Answers

1. What happened in the winter experiment (there was sunlight and pollution, but no heat)?
   The sun was out and there was VOCs and NOx present, but no pollution formed.
2. What happened in the summer experiment (there was sunlight, pollution, and heat!)?
   The sun came out and heat was present to "cook" the pollution to make ozone.
3. What happened when there was no pollution?
   The sun was out with heat, but when there was no pollution to use to make ozone, the air stayed clean and clear.

Now, divide the class up into different particles. Have the students wait on the side until the teacher calls out their "source." Tell the students that a large truck is driving down a gravel road (the students labeled "dust" should start floating around in the air). Now tell students that a factory nearby is emitting water vapor into the air (the students labeled "water vapor" should begin to float in the air. Next tell students that a bunch of homes in a neighborhood are running leaf blowers at the same time, and a few houses are having outdoor fires (students labeled "air pollution" should begin floating around in the air). Lastly, tell the students that there are allergens (things that cause allergies, such as fragments of pollen, mold spores, etc) floating around in the air as well (the students labeled "allergens" float in the air).

Explain that it is summer and 90 degrees outside with the sun shining bright! The students should all still be floating in the air. Then tell the students it is the middle of winter and the temperature is 25 degrees outside with cloudy skies. The students should still keep floating around in the air. Through this experiment, students will recognize that particle pollution can form anytime of the year in Wisconsin.

Student Worksheet Answers

OK, now it's time to make some particle pollution. List a few pollutants that can be in particle pollution.

dust	water vapor
air pollution	pollen / mold spores (which kids have allergies?)

1. What happened in the summer experiment?
   All of the particles floated around in the air causing particle pollution to form.
2. What happened in the winter experiment?
   All of the particles still floated around in the air causing particle pollution to form.

Wrap Up:

1. What type(s) of pollution can form in the winter?
   Particle pollution
2. What type(s) of pollution can form in the summer?
   Particle pollution and ozone

Remember:

- Teachers, please remember to post or make available the **bold-faced** vocabulary word definitions in each activity *(see the glossary on page 65 for definitions).*

Student Labels

sun

heat

oxygen

NOx

VOC

dust

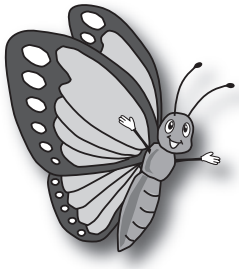
water vapor

air pollution

allergens

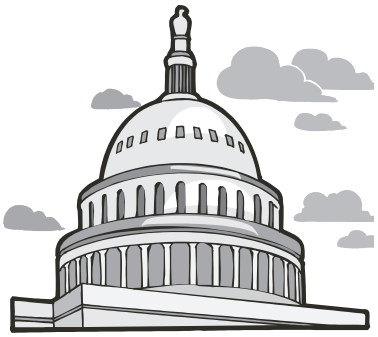
Name_____ Date_____

The Clean Air Act



In Washington DC, our nation's capitol, many interesting and important things happen everyday. Lawmakers, whom your parents vote for at elections, go to work to help pass laws to make our country better.

Our government passed the **Clean Air Act** in 1970. An act is a type of law or decision. The Clean Air Act was created to help keep our air clean and protect our health, but how? The Act helped create laws that limit the amount of pollution and the types of pollution we are allowed to have in our air.



There is a group of pollutants we measure to tell us how dirty or clean the air is. These pollutants can affect our health so it is important that we learn about them.

- **Carbon Monoxide** (CO) –in exhaust from cars, trucks, and buses
- **Lead** – in paint in older homes
- **Nitrogen Oxides** (NOx) - from car, truck, and bus exhaust
- **Ozone** – forms when 2 chemicals (VOCs and NOx) are "baked" in the sun and heat
- **Particle Pollution** – in smoke of all kinds, or from dust or **allergens**
- **Sulfur Dioxide** (SO_2) – from power plants, which burn coal or other fuel to make electricity
- **VOCs** – from smelly things like skunks, markers, gasoline and paint

Activity

Let's *act out* the Clean Air Act! For this clean air act we won't be writing laws or going to Washington D.C., but we are going to investigate where two types of pollution come from and then act out how they form! These are the two pollutants that sometimes cause us problems here in Wisconsin – ozone and particle pollution. Are you ready?

Name_____ Date_____

Ozone

1. What do you need to create ozone? Circle the correct answers below.


candy


sunlight


basketball


rainy skies

VOCs


backpack

NOx

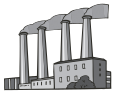

heat

2. Now that you know what you need to create ozone, circle a few places that VOCs and NOx come from.


flip flops


cars

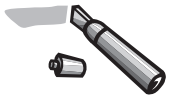

buses


factories


paint


lawnmower


bike


marker

Particle Pollution

1. Particle Pollution can be made up of many different pollutants. Circle the things that might be part of particle pollution.


water vapor


smoke


crayons


camera


allergen


dust

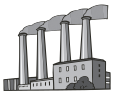

soccer ball

2. Where do these particles come from? Circle the answers below.


dusty road


pinwheels


tailpipe


factories


toothbrush


bird


fire

Name_____ Date_____

Now let's act out how ozone forms. First, what do you need to create ozone?
Fill in the spaces below.

_____ _____

_____ _____

Now, let's make some ozone! Your teacher will divide the class up into ozone "parts." Remember which "part" you are. Now, have the pollution float around in the air and watch what happens!

1. What happened in the winter experiment (there was sunlight and pollution, but no heat)?

2. What happened in the summer experiment (there was sunlight, pollution, and heat!)

3. What happened when there was no pollution?

OK, now it's time to make some particle pollution. List a few pollutants that can be found in particle pollution.

_____ _____

_____ _____

Now, we'll create some particle pollution. Your teacher will assign each student to be a particle. Let's see what happens…

1. What happened in the summer experiment?

2. What happened in the winter experiment?

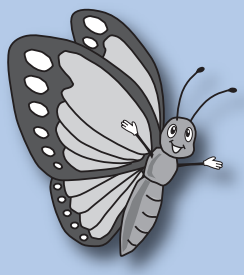
Wrap Up

1. What type(s) of pollution can form in the winter?

2. What type(s) of pollution can form in the summer?

Milkweed Magic

ACTIVITY 7



Learning Objectives:

- Introduce the concept of biomonitoring.
- Identify ozone injury to common milkweed leaves
- Demonstrate how human actions can impact the natural world.

Subject

- Science

Materials

- Milkweed Magic student worksheet

Teacher's Background Information

NOTE: If students have not learned about ozone, use the Introduction section to review what ozone is, how it's formed, and how it can impact human health prior to completing this activity.

Did you know that plants and animals can give us clues about pollution in our air, land, and water before humans even notice that something is wrong? These sensitive species are called bioindicators. One way your students can learn more about air pollution is to study the plant common milkweed. Common milkweed is very sensitive to air pollution, in particular, ground level ozone. In Wisconsin, common milkweed is a good plant to study because it grows all over the state.

In this activity, your students will become biomonitoring scientists while conducting a simple ozone injury check-up on milkweed. Ozone injury can be seen on the leaves of milkweed plants. The "injury" is unique and is pretty easy to identify – a little black polka-dot called a stipple. Stipples form when ground level ozone attacks the photosynthesizing (or food producing) cells of the plant and actually causes the cell to break open and die. Once dead the cell turns black, looking like a little black polka-dot on the leaf surface. If enough cells on the leaf die, the plant may pull out its nutrients from that leaf and just let the leaf die and drop. If enough leaves are dropped from the plant, the plant may not be able to make enough food to survive.

Here is the checklist of what ozone injury looks like on milkweed plants:

- ☐ **Stipples (black dots) are found only between the veins, not on them.**

  This is because ground level ozone only affects the photosynthesizing cells and the veins are not photosynthesizing cells, they are vascular cells which transport food and water to and from cells.

- ☐ **Stipples are found only on the upper leaf surface.**

  Again, the bottom of the leave is filled with stomata – the air vents on the plant, not used for photosynthesis.

- ☐ **Stipples have distinct, sharp edges.**

  This is because each stipple is one cell that has died and cells have walls (sharp edges).

- ☐ **No haloes or discoloration around the stipple.**

  Again, each cell has walls so when one cell dies it does not harm the cells around it.

- ☐ **Stipples are black or very dark in color.**

  The cell is broken open and no longer contains fluid.

- ☐ **Stipples are scattered over the leaf surface, not clustered in groups or in obvious shapes such as circles.**

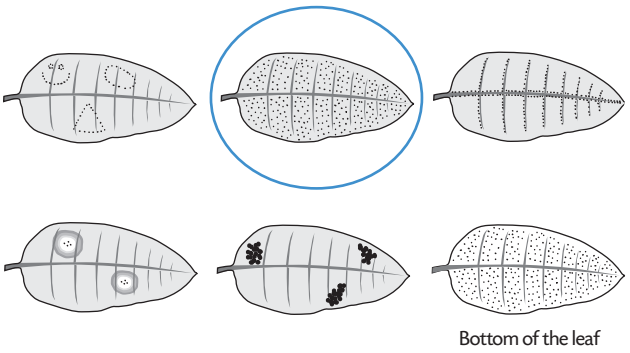
  Ground level ozone affects cells randomly, not in clusters or shapes.

Student Worksheet Answers

What do you need to live?
(in no particular order)

1. Food
2. Shelter
3. Water
4. Air

Circle any leaves with ozone damage.



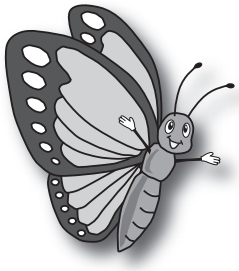
For more examples of milkweed leaves and damage to the leaves, please visit EEK! the DNR's website for kids and teachers at dnr.wi.gov/eek. Type "milkweed slide show" into the search bar. If you are interested in expanding your milkweed study, check out the DNR's Milkweed Monitoring Network. It is a program to get kids outside to study real milkweed plants for ozone damage.

Remember:

- Teachers, please remember to post or make available the **bold-faced** vocabulary word definitions in each activity *(see the glossary on page 65 for definitions).*

Name _____ Date _____

Milkweed Magic



Now that you know what **ozone** is and how it impacts human health, you are probably wondering if ozone can be harmful to plants and animals. The answer is YES, and the close relationship between a plant called **milkweed** and the monarch butterfly will show us how.

Necessities of Life

What do you need to live?

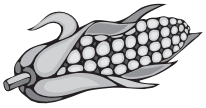
1. _____
2. _____
3. _____
4. _____

I bet food was at the top of your list. What type of food do you like? Circle the pictures of foods you like.


ice cream


water


pizza


corn


green beans


apple


cake


carrots

Monarch butterflies need the same types of things you do. What do you think their diet includes? Circle the pictures of the food you think monarch butterflies like.


dandelions


soda


flies

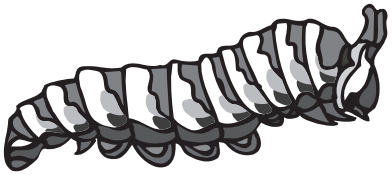

water


lilacs


hamburger


milkweed


cupcake



Unlike us, the caterpillars of a monarch have a very specific diet. They exclusively eat milkweed leaves, which are actually poisonous to most other creatures.

Name_____ Date_____

Impact of Ozone on Milkweed

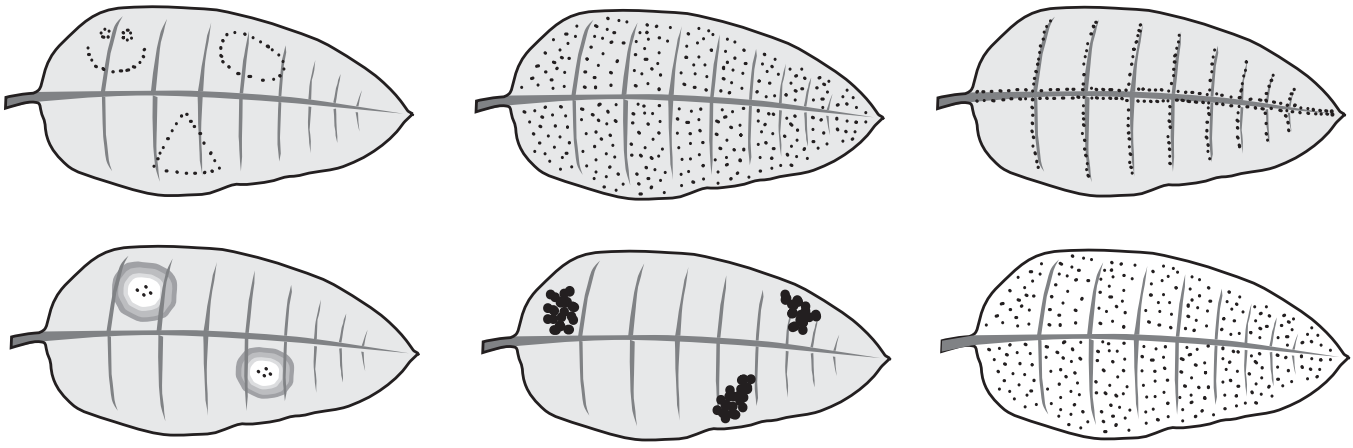
Did you know that plants and animals can give us clues about **pollution** in our air, land, and water, before humans even notice that something is wrong? **Biomonitoring** is the term scientists use to describe the use of plants, animals, or entire ecosystems to learn if our environment is polluted. In Wisconsin, common **milkweed** is a good plant to study because it is affected by **ozone** and it grows all over the state!

The presence of ozone in the air surrounding milkweed plants causes small stipples, or dark polka dots, to appear on the milkweed leaves. This damages the leaves and can harm the whole milkweed plant, or even cause the plant to die if it gets too damaged.

Signs of ozone damage:

- stipples (black dots), found only between the veins, not on them
- stipples are found only on the upper leaf surface
- stipples have distinct, sharp edges
- no haloes or discoloration around the stipple
- stipples are black or very dark in color
- stipples are scattered over the leaf surface, not clustered in groups or in obvious shapes, such as circles

Circle any leaves with ozone damage.



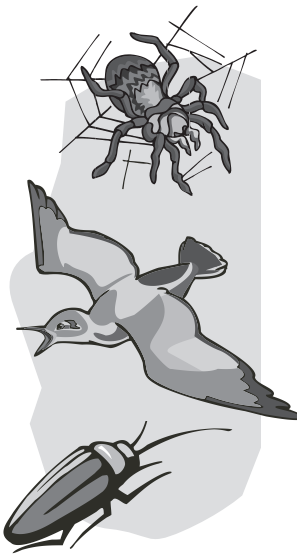
Bottom of the leaf

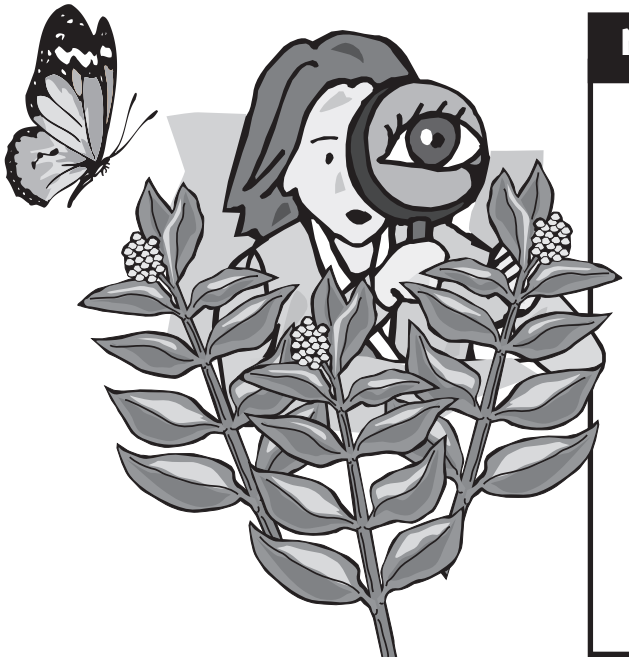
Name_____ Date_____

The monarch relies exclusively on milkweed to lay its eggs and as a food source for the caterpillar.

1. If milkweed is damaged by ozone how might this impact the monarch population?

2. What about other critters that feed on monarchs, like insects, spiders, and some birds, how might their populations be impacted?





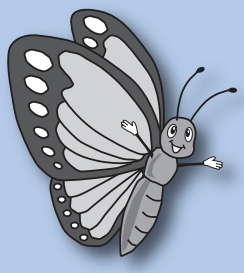
Nature Detective

Explore the area around your school or house for milkweed and look for signs of ozone damage. If you cannot find any milkweed plants, plant your own. Not only will you be able to search the leaves for signs of ozone damage, but you'll also create habitat for the butterflies!

Hint: Late summer and early fall are good times to look for signs of ozone damage on milkweed.

AQI Detectives

ACTIVITY 8



Learning Objective:

- Understand the Air Quality Index and learn how to find the daily air quality.

Subjects

- Health
- Social Studies

Materials

- Computer with internet access
- Crayons, colored pencils, or markers
- AQI student worksheet

Teacher's Background Information

NOTE: If students have not completed activities Does Clear Air = Clean Air? or The Clean Air Act, teachers may want to discuss where air pollution comes from and how it affects our health.

Wisconsin's Air Quality is generally good, but occasionally becomes unhealthy. The Air Quality Index (AQI) is a tool used to tell people the daily air quality. It uses 4 colors to convey the quality of the air: green is good, yellow is moderate, orange is unhealthy for sensitive groups, and red is unhealthy for everyone. Associated with the colors are AQI values. The lower the AQI value, the cleaner the air. AQI values of 0–50 are good, 51–100 are moderate, 101–150 are unhealthy for sensitive groups, and 151–200 are unhealthy for everyone.

Included in the sensitive group are:

- People with asthma or other respiratory illnesses
- Children
- Older adults
- People with heart disease
- Those who work outdoors
- Those who exercise or spend extended periods of time outdoors

Those sensitive to air pollution should limit outdoor exposure and avoid strenuous activities on days with poor air quality. DNR will issue an Air Quality Advisory (AQA) when the level of air pollutants have reached or exceeded the orange range.

The health effects of air pollution on humans may occur immediately, after a few hours, or even after a few days. Though it can be difficult to see or smell air pollution, we are still breathing it deep into our lungs with each breath. Exposure to air pollutants can cause eyes, nose and throat irritation, shortness of breath, coughing, wheezing, or chest pain. Air pollution can also increase the severity and occurrence of asthma attacks, aggravate emphysema, chronic bronchitis and other lung ailments, and can also affect those with heart disease.

There are many ways to find current air quality conditions in your area, or see if an AQA has been issued. You can:

1. Log on to Air Now (http://www.airnow.gov/) and click on your state.
2. Check the DNR website (http://dnr.wi.gov/air/aq/health/status.asp)
3. Sign up to receive e-mail notification from the DNR when an AQA is called (http://dnr.wi.gov/air/aq/health/status_county.asp).
4. Check many weather forecast sites or stations including www.weatherunderground.com, a newspaper, weather radio, or TV weather sites.

Student Worksheet Answers

What is the current AQI?

Example: Milwaukee

Color: green AQI #: 32 Conditions: good

What is the forecast for tomorrow?

Color: yellow Conditions: moderate

Fill in the AQI chart below:

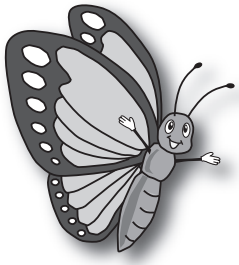
Air Quality Index Values	Levels of Health Concern	Colors
When the AQI is in this range:	*. . . air quality is:*	*. . . as shown by this color:*
0 to 50	**Good**	**Green**
51 to 100	**Moderate**	**Yellow**
101 to 150	**Unhealthy for Some People**	**Orange**
151 to 200	**Unhealthy**	**Red**

Remember:

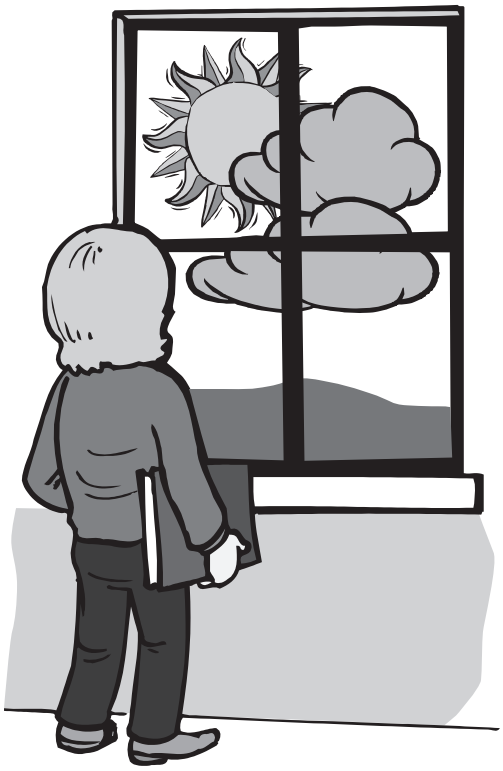
- Teachers, please remember to post or make available the **bold-faced** vocabulary word definitions in each activity *(see the glossary on page 65 for definitions).*

Name_____ Date_____

AQI Detectives



Have you ever heard of a thunderstorm, tornado, or winter weather advisory? Of course you have. An advisory is called when bad weather is happening – weather that could be dangerous!



Have you ever heard of an **Air Quality Advisory** (AQA)? Air Quality Advisories are just like thunderstorm, tornado, or winter weather advisories. This is the warning system used to alert people when the quality of the air is poor and might affect their health. Remember, if you have **asthma** or are sensitive to **air pollution** you will want to know when the air quality is going to be bad.

AQI

Let's find out what the quality of the air is today...

First we need to learn about the AQI, or **Air Quality Index**. This is a tool we use to show if the air is clean or dirty.

Air Quality Index Values	Levels of Health Concern	Colors
When the AQI is in this range:	*... air quality is:*	*... as shown by this color:*
0 to 50	**Good**	**Green**
51 to 100	**Moderate**	**Yellow**
101 to 150	**Unhealthy for Some People**	**Orange**
151 to 200	**Unhealthy**	**Red**

Name_____ Date_____

Just like a stoplight, green means go and red means stop! If the air quality is green, it means it is good and there is almost no pollution in the air so we can go outside and play. If the air quality is in the yellow range, there is some air pollution floating around in the air, but most people won't notice it, so we can still play outdoors.

If the air quality gets into the orange range, sensitive people might begin to feel the effects of poor air quality. (Who is in the sensitive group? Do you know? Check out the box below to find out.) People in the sensitive group should really be careful and slow down outdoors on these days. If the air quality reaches the red range, everyone will begin to feel the effects of air pollution! Yikes!

Luckily in Wisconsin, we don't see the red AQI range very often at all. We do see a few orange days, but most of our days are in the green and yellow ranges.

The Sensitive Group

Listed here are people included in the "sensitive to air pollution" group.

- people with asthma
- kids
- older adults
- people with other respiratory illnesses
- people with heart problems
- people who work or do strenuous exercise outdoors.

Where does our air pollution come from?

Well…all over the place! Air pollution is released into the air from cars, trucks, factories, and power plants. Each time we drive our car, turn on a light in our house, or have a fire in our fireplace, we release small amounts of pollution into the air. Over time it can really add up! This is why it is important to keep our air clean and reduce air pollution whenever we can.

Name _____ Date _____

Let's use the AQI chart to figure out the air quality today!

Log on to the Internet and visit AirNow (http://www.airnow.gov/). Click on the state of Wisconsin on the U.S. map. Now, look through the cities listed and find the city that is closest to where you live.

What is the current AQI?

Color: _____

AQI #: _____

Conditions: _____

What is the forecast for tomorrow?

Color: _____

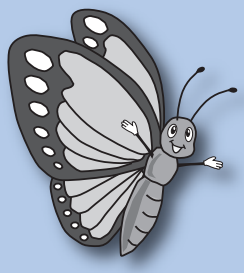
Conditions: _____

Now, without looking at the AQI chart on the first page for the answers, fill in the chart and then color it in.

Air Quality Index Values	Levels of Health Concern	Colors
When the AQI is in this range:	*. . . air quality is:*	*. . . as shown by this color:*
0 to 50		
51 to 100		
101 to 150		
151 to 200		

Breathing Is Easy, Isn't It?

ACTIVITY 9



Learning Objective:

- Introduce asthma and demonstrate how it may feel to have an asthma attack.
- Understand asthma triggers and that air pollution is one of those triggers.

Subjects

- Health
- Science

Materials

- Cocktail straws or coffee stir-sticks
- Soda size straws
- Breathing is Easy, Isn't It? student worksheet

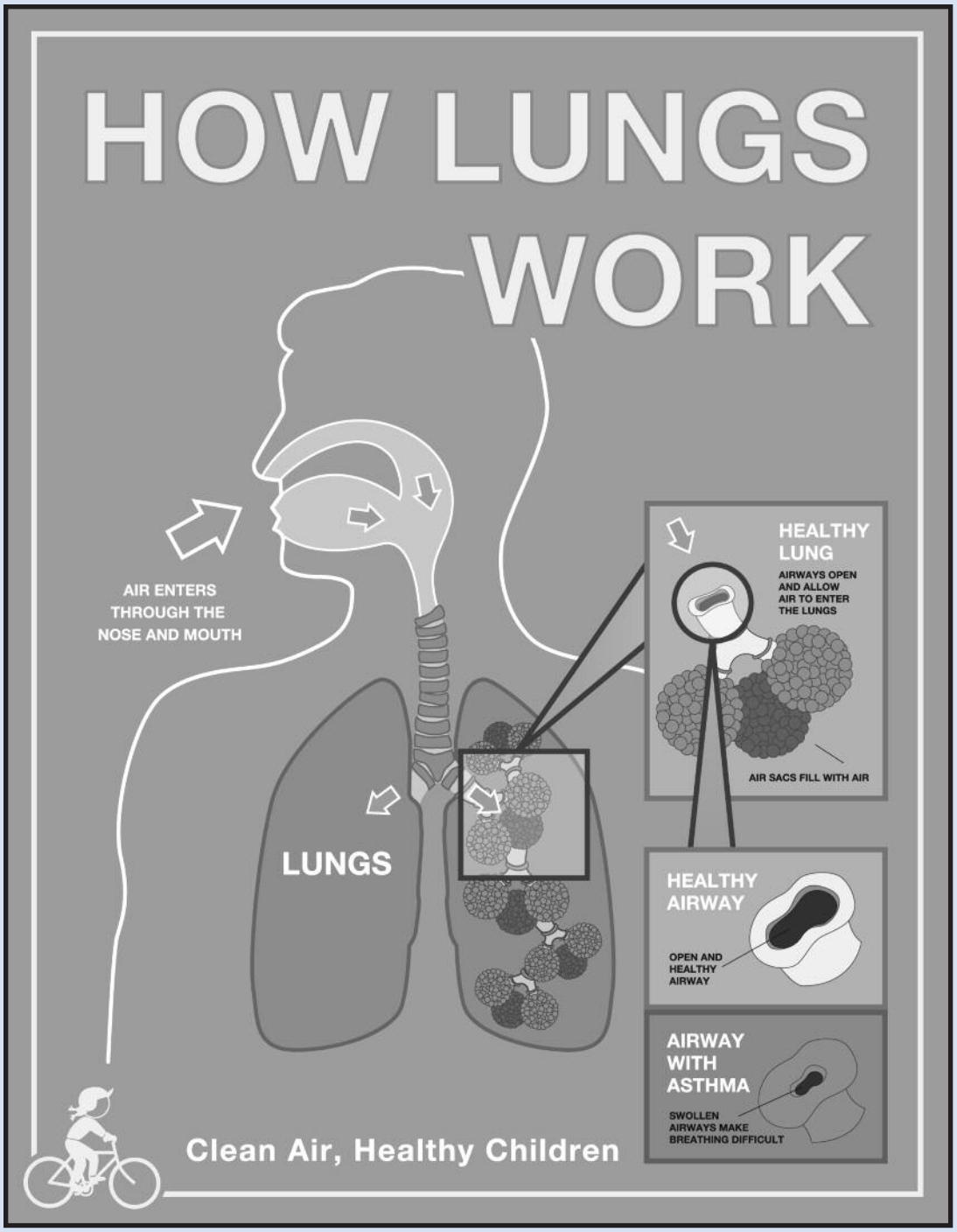
Teacher's Background Information

NOTE: This activity may be difficult for students with asthma.

Air pollution can affect the health of everyone, from mild irritation of the eyes and throat to causing an asthma attack. Asthma is a chronic lung disease that can affect people of all ages. In fact, asthma is the leading serious chronic illness of children. In this activity, the students will learn what it may feel like to have an asthma attack by breathing through straws of different diameters. Breathing through the wider straw is relatively easy. Then students try breathing through the narrow straw, which represents the narrowed airways of an asthmatic during an attack; and they realize how difficult it is to breathe.

So what happens during an asthma attack? A few things happen (see graphic): The airways (throat, bronchial tubes, and bronchioles) narrow due to swelling and inflammation. Also, the muscles around the airways tighten, further narrowing the airways. And lastly, excessive mucus is produced in the airways further blocking air flow.

Many things can trigger an asthma attack, such as cold air, pet dander, dust mites, exercise, or air pollution; so it is important for people with asthma to learn their triggers. Students will learn about asthma triggers in this activity as well.



For more information about the sources of air pollution and what we can do to reduce air pollution, see the Introduction section.

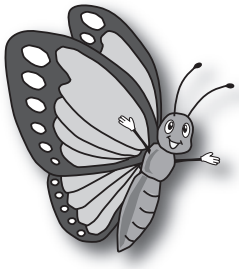
For more information on asthma visit the American Lung Association or request a free copy of Clean Air Healthy Children from the DNR. To order please e-mail *DNRAirEducation@wisconsin.gov*.

Remember:

- Teachers, please remember to post or make available the **bold-faced** vocabulary word definitions in each activity *(see the glossary on page 65 for definitions).*

Name _____ Date _____

Breathing Is Easy, Isn't It?

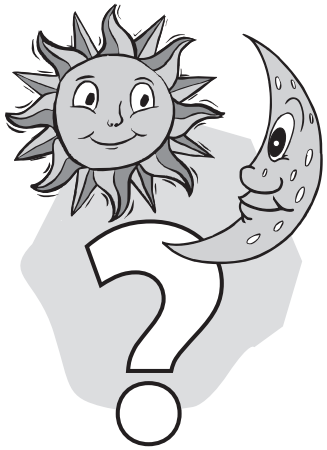


Here's a riddle for you. See if you can guess what this is:

> It is something we do all day long – even when we are sleeping.
> And it is so important we couldn't live without doing it. What is it?

Do you know the answer?

___ ___ ___ ___ ___ ___ ___ ___ ___



Do you know why breathing is so important? Each and every breath we take brings **oxygen** into our body. Our brain, organs, and muscles need oxygen to work properly. So breathing in clean air is important for our bodies.

Activity

For this activity, please find two different-sized straws. Make sure one is skinny (like a coffee stirring straw) and one is fatter (like a soda straw).

- Put the big straw in your mouth and plug your nose. Try to breathe only though the straw. Can you do it? What did it feel like?

But what if you had **asthma**? Would breathing always be so easy? Let's find out…

- Now pick up the skinny straw. Put it in your mouth and plug your nose like before and try breathing only through the straw. What does it feel like? Is it harder or easier to breathe through the skinny straw?

Name _____ Date _____

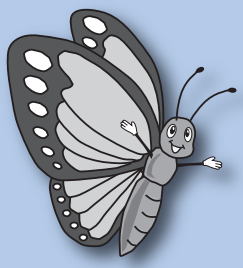
Not everyone has asthma, but people that do have things called asthma attacks. During an asthma attack, the airways that bring oxygen into the body tighten and swell making it hard to breathe in or out. In other words, your airways can go from the "soda straw size" to the "coffee stir stick size" making it really hard to breathe. Trying to breathe through the skinny straw may be what it feels like to have an asthma attack. Ask someone who has asthma if this is what it feels like.

Lots of things can cause an asthma attack and it is important to learn your **asthma triggers** (things that can cause an attack) if you have asthma. Triggers can be pet fur and feathers, cold air and exercise, and even **air pollution**. When we breathe in, we let everything in the air into our bodies. So if the air is really dirty, we breathe all of that dirt and pollution into our bodies – YUCK! Whether or not you have asthma, breathing in dirty air is not good for you. Dirty air can irritate healthy lungs and cause coughing and wheezing and it can trigger an asthma attack in people with asthma. Remember, keeping our air clean is good for all of us!

What can we do to help reduce air pollution and keep the air we breathe healthy for all of us?

Air Quality Know-It-All

ACTIVITY 10



Learning Objective:

- Review and assess what the students have learned about air pollution.
- Reinforce that student actions can have a positive impact on air quality.

Subject

- Social Studies

Materials

- Indoor or outdoor game space
- Air Quality Know-It-All student worksheet

Teacher's Background Information

This activity has two parts – a game involving a quiz and pledge cards. You can do both parts of this activity or just either one.

Part 1

Your students have worked hard to complete activities in this guide and now it is time for some fun. Line the students up on a horizontal line (either in the gym, or outside on the playground, or on a soccer field). Leave enough room for the students to move forward a good number of steps (15–20). Show the students where the finish line is.

Now, ask the class to take out their papers and write their names on them. (You can also do this activity paperless and just have the students move on their honor.) Now explain to the students that you will ask them a question about air quality and they will have a minute to write their answer down on their paper. Then call on a student to answer the question. All students who answered correctly can take two steps forward. Those who did not have the correct answer stay where they are. Continue until there is a winner (or Air Quality Know-It-All).

There are questions on the next few pages for each activity in this guide. Pick questions that were covered in the material you taught.

Part 2

After the game have students fill out their Air Quality Pledge card. Have a brainstorming session before about some possible tasks the students can pledge to do:

- Turn the lights off when I leave the room.
- Don't leave my MP3 charger plugged in all of the time.
- Ask mom and dad to turn down the heat in the winter by a few degrees and put a sweater on. Or turn up the temperature on the air conditioner in the summer.
- Don't leave the TV on when no one is watching it.
- Recycle more at home and school.
- Reuse your lunch bag.
- Ride your bike to school or to your friend's house instead of asking mom or dad to drive.
- Teach my little sister/brother to recycle.

For more ideas visit the DNR's Do A Little Save A Lot Web page.

***After each student has filled out their pledge card show the class how many pledges there are.**

Remind students that even the little tasks can really add up to cleaner air!

Activity Questions

1. **Q:** We all do this all day and all night without even thinking of it.
A: *breathe*

2. **Q:** True or False: Asthma makes it hard for people to eat peanut butter.
A: *false*

3. **Q:** This is a gas in air that we need to survive.
A: *oxygen*

4. **Q:** A disease that makes it hard for us to breathe, especially when we come into contact with one of its triggers.
A: *Asthma*

5. **Q:** List one asthma trigger.
A: *pets, cold air, air pollution, allergens, exercise*

6. **Q:** This is a color-coded scale we use to show if there is pollution in the air.
A: *AQI or Air Quality Index*

7. **Q:** It is like a winter weather advisory or tornado warning, but for air quality.
A: *AQA or Air Quality Advisory*

Continued on next page.

Activity Questions

7. **Q:** It is like a winter weather advisory or tornado warning, but for air quality.
A: *AQA or Air Quality Advisory*

8. **Q:** True or False: The air we breathe has more then one gas in it?
A: *true*

9. **Q:** Our government signed this in 1970 to protect our air.
A: *Clean Air Act*

10. **Q:** This type of air pollution happens ONLY in the summer in Wisconsin.
A: *ozone*

11. **Q:** This type of air pollution happens any time of the year in Wisconsin.
A: *particle pollution*

12. **Q:** Where does most of our energy come from?
A: *power plant or coal*

13. **Q:** Which gives off more pollution, riding your bike or driving a car to school?
A: *driving a car*

14. **Q:** True or False: Air pollution can come from smoky fires.
A: *true*

15. **Q:** What plant gets stipples, or polka-dots, on it when there is a lot of air pollution?
A: *milkweed*

16. **Q:** Does ground level ozone affect the upper or lower side of milkweed leaves?
A: *upper*

17. **Q:** Does air weigh anything?
A: *yes, air has mass*

18. **Q:** Name 2 ways you can sense that air is around us.
A: *see, hear, touch, taste, smell*

19. **Q:** True or False: Children and older adults are in the "sensitive to air pollution group?"
A: *true*

20. **Q:** On the AQI chart what color means good air quality?
A: *green*

21. **Q:** On the AQI chart what does red mean?
A: *Air quality is bad. Everyone needs to be careful outside.*

Continued on next page.

Activity Questions

22. **Q:** Measuring air pollution is one way we can determine ___ _____.
A: *air quality (Hint this answer is a glossary word)*

23. **Q:** Which one of these things is good for air quality: Turning off the lights when you leave a room or starting up the lawn mower and letting it run while you talk to the neighbor?
A: *turning off the lights*

24. **Q:** Which one of these places can you check the air quality, on the internet, in the paper, or on the news?
A: *all of the above*

25. **Q:** What pollutant is formed when VOCs, NOx, sunlight, and heat all come together?
A: *ozone*

26. **Q:** Name one pollutant that can be in particle pollution.
A: *dust, smoke, water vapor, allergen*

27. **Q:** True or False: You should pay attention to air quality even if you do not have asthma?
A: *True. Many people can be sensitive to air pollution. Children, older adults, or people who work or play outside can all be affected by poor air quality.*

28. **Q:** Which of these is good for air quality – recycling more or unplugging things in your house when they are not in use?
A: *both*

29. **Q:** True or False: If the air is clear it must be clean, with no pollution in it.
A: *False. We cannot always see air hitchhikers (or air pollution).*

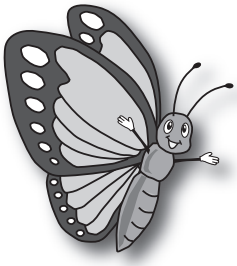
30. **Q:** True or false? Kids can't help keep our air clean.
A: *False. Kids can have a huge part in keeping our air clean. Kids can do big things and little things to help keep the air clean. Remember, it all adds up to cleaner air!*

Remember:

- Teachers, please remember to post or make available the **bold-faced** vocabulary word definitions in each activity *(see the glossary on page 65 for definitions).*

Name _____ Date _____

Air Quality Know-It-All



Hello Air Heads! After completing air quality activities you know a lot about where **air pollution** comes from and why it is important to reduce pollution whenever possible. Now it's time to test your skills! Your teacher will ask you some questions. Fill in your answer below. If you get the answer right you get to move ahead 2 steps. If you get the answer wrong you have to stay where you are. Whoever gets to the finish line first becomes the class Air Quality Know-It-All and wins! Good Luck!

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____
14. _____

After the game, make sure to fill out your pledge card.

Remember every little bit helps, because it all adds up to cleaner air!

PLEDGE

I pledge to keep the air clean by:

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Signature _____ Date _____

Air, Air Everywhere Glossary

Air Hitchhiker – pollution that travels in the air – like dust, gases or pollen.

Air Pollution – gases or particles floating around that may cause some people to get sick.

Air Quality – how clean or dirty the air is. The better the air quality, the cleaner it is.

Air Quality Index – a color-coded scale that tells us if the air is clean or dirty each day.

Air Quality Advisory – a warning system used to let people know when air pollution is high.

Allergen – something that can cause an allergic reaction. Pollen, mold, pet fur, and peanut butter are all examples.

Argon – a very common gas in air that has no taste, smell, or color. We use it in light bulbs!

Asthma – a disease that makes it hard for some people to breathe.

Asthma Trigger – something that can cause a person to have a hard time breathing or an asthma attack. Examples: pet fur and feathers, air pollution, exercise, and cold air.

Biomonitoring – the act of using plants and animals to find out if there is pollution in our environment.

Carbon Dioxide (CO_2) – the gas that we breathe out all day and night long. Can also come from cars and factories. Plants need this gas to live.

Carbon Monoxide (CO) – a gas with no smell or taste. It comes from car, bus, plane, boat, and truck exhaust and can be very dangerous to our health.

Clean Air Act – a law our government passed in 1970 to help protect our air and clean it up, and guess what? It's working! All of the actions taken because of the Clean Air Act are making our air cleaner each year.

Habitat – place where a plant or animal lives because it has all the food and shelter it needs there.

Interview – a way of asking someone questions (and listening for the answers) to find out something that you wanted to know.

Lead – a substance that can be dangerous and harm people if they breathe it in or eat it. Old paint can be loaded with lead and we breathe it in when people burn homes and furniture with old paint.

Milkweed – a common plant in Wisconsin that can be harmed by the air pollutant ozone.

Nitrogen – a gas that is the most common ingredient in the air.

Nitrogen Oxide (NOx) – a type of gas from car, truck, and bus exhaust. It can be hard to breathe if there is too much of it in the air.

Oxygen – the gas we all need to live! We breathe it into our bodies to keep them working properly. Oxygen makes our muscles, organs, and brains work.

Ozone – a pollutant that forms when VOCs and NOx bake in sunlight and heat. Ozone can irritate our eyes, nose, and throat when we breathe it in. In Wisconsin ozone forms only in the warm summer months.

Particle Pollution – made up of teeny tiny particles such as dust, pollen, or droplets that float around in the air. They are so small you cannot see them. Particle pollution can form all year long in Wisconsin!

Pollution – anything in the environment that should not be there and makes the land, water, and air dirty. Can include dust, litter, or chemicals.

Power Plant – a building and machinery that makes electricity and from where we get most of our energy.

Stipple – a small black or dark colored polka-dot on the top of a milkweed leaf caused by too much ozone in the air.

Sulfur Dioxide (SO_2) – an air pollutant that comes from power plants, industries, and volcanoes. It is unhealthy to breathe, but it can also be used to keep fruit fresh!

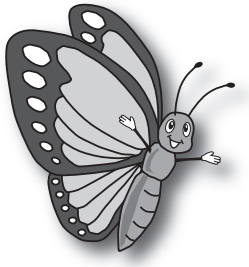
Volatile Organic Compound (VOCs) – pollutants from car exhaust, factories, and even paint, markers, and nail polish remover. VOCs can smell funny.

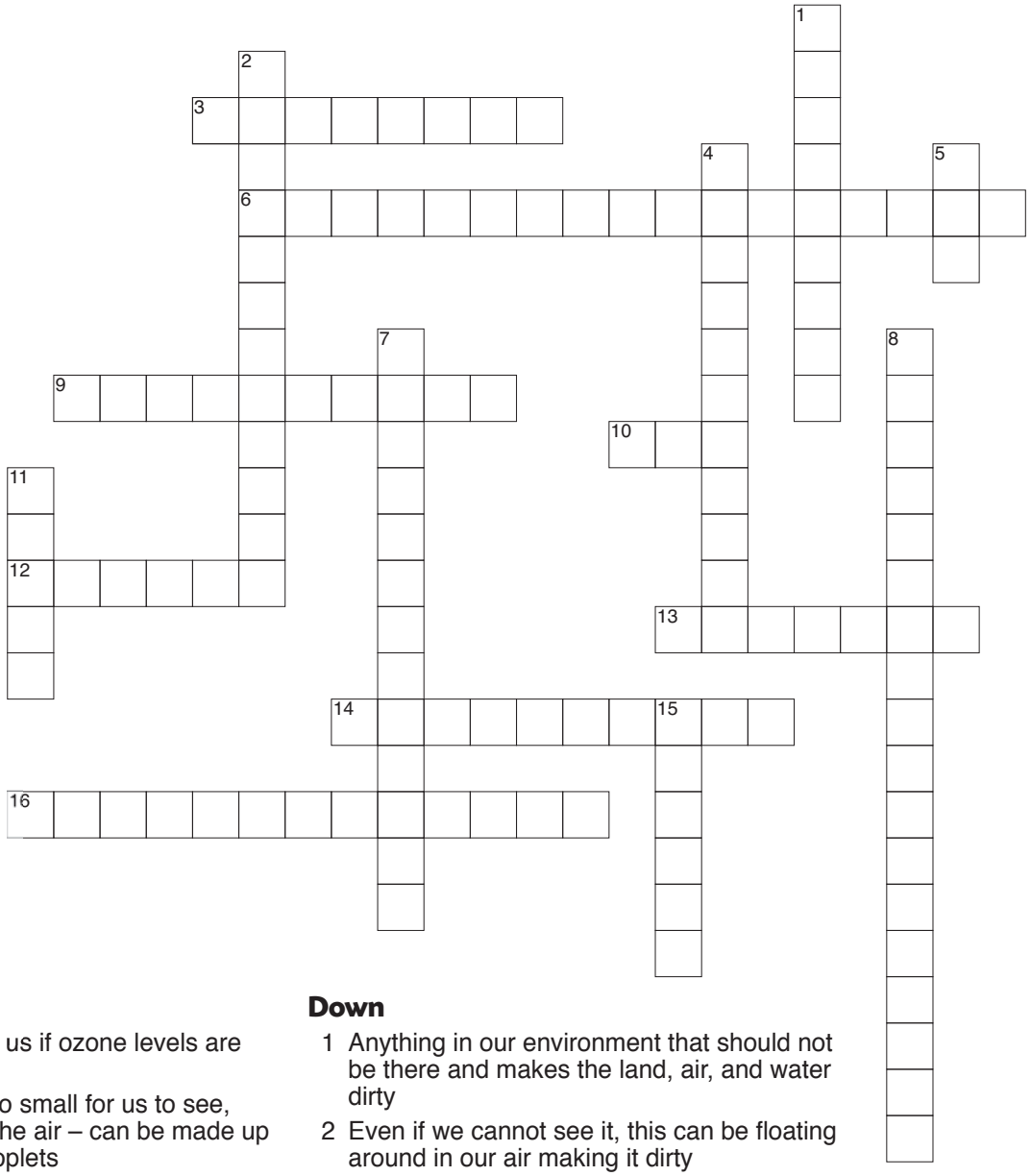
Name_____ Date_____

Crossword Puzzle

Words

air pollution
air quality
air quality advisory
AQI
asthma
asthma trigger
biomonitoring
clean air act
milkweed
oxygen
ozone
particle pollution
pollution
powerplant
stipple
VOC





Across

3 This plant can show us if ozone levels are high
6 Teeny tiny things, too small for us to see, that float around in the air – can be made up of dust, pollen or droplets
9 When this is good we breathe easily
10 Three-letter name for the color-coded scale that tells us about the quality of the air
12 This is a gas we all need to live – we breathe it in all day and all night
13 A small dark polka-dot on the upper side of a milkweed leave from air pollution
14 Type of building where most of our energy comes from
16 For example: pet fur and feathers, cold air, exercise, or air pollution

Down

1 Anything in our environment that should not be there and makes the land, air, and water dirty
2 Even if we cannot see it, this can be floating around in our air making it dirty
4 Our government passed this in 1970 to help keep the air clean
5 Three letters that stand for a chemical that can smell really funny – in markers, paint, or nail polish remover
7 Using plants and animals to see if there is pollution in our environment
8 A warning system used to tell people when air pollution is high
11 This forms when VOCs and NOx bake in the sun and summer heat
15 A disease that makes it hard for some people to breathe and can be triggered by high levels of air pollution

Air, Air, Everywhere

Evaluation

Thank you for talking the time to fill out this evaluation form. We want to hear from you and appreciate all of your comments! Please send evaluations to Air, Air Everywhere Evaluation, Wisconsin DNR – AM/7, PO Box 7921, Madison, WI, 53707-7921; e-mail *DNRAirEducation@wi.gov,* or fax (608) 267-0560.

1. Grades Taught: _____

2. Overall, how would you rate this activity guide compared to others you have used? Why?

   Inferior 1 2 3 4 5 Superior

3. Was the activity appropriate for the grade(s) you teach?

   Too basic 1 2 3 4 5 Too advanced

4. Were the learning objectives reached during the activity/activities?

   No, none yes, some yes, all yes, exceeded

5. Did your students enjoy the activity/activities?

   Hated it 1 2 3 4 5 Loved it

6. Did you find the Introduction section useful?

   Did not read it 1 2 3 4 5 Learned so much, I read it twice!

7. Did the Teacher's Supplement before the activity/activities give you enough information to answer questions and lead the activity/activities?

   No, not at all 1 2 3 4 5 Yes, I felt extremely prepared

8. Were the activities written so they could be easily understood and successfully completed?

   Very inadequate 1 2 3 4 5 Too much information

9. Please list the activity/activities you taught, and grade them (A–F). Also add any comments you have about the activity/activities.

Activity:	Grade:	Comments:

10. Any other comments?

Please fill out the information at the right if you would like to be added to our DNR Education Listserv. E-mail updates are sent out quarterly to keep you informed of any upcoming conferences, workshops or new resources available.

You can also sign up on-line by visiting us at **dnr.wi.gov** and clicking on the "subscribe to DNR updates" button.

Name _____

School _____

Address _____

City _____

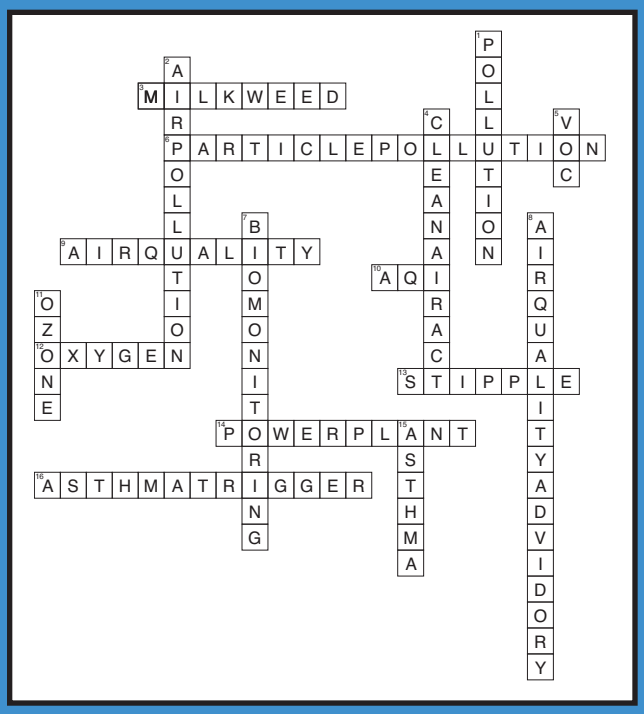
State _____

Zip Code _____

E-mail Address _____

Air, Air, Everywhere

Crossword Answer Key (page 64)



Air Quality Index

Air Quality Index Values	Levels of Health Concern	Colors
When the AQI is in this range:	*. . . air quality is:*	*. . . as shown by this color:*
0 to 50	**Good**	**Green**
51 to 100	**Moderate**	**Yellow**
101 to 150	**Unhealthy for Sensitive Groups**	**Orange**
151 to 200	**Unhealthy**	**Red**

Wisconsin Department of Natural Resources

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