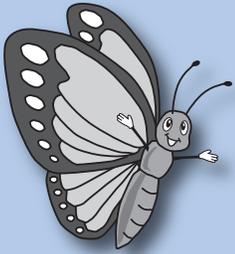


The Clean Air Act

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.

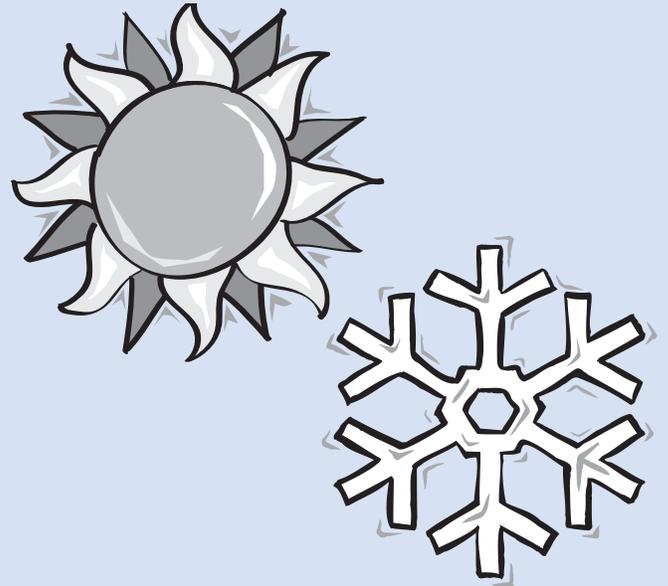
Students should understand the basic structure of our government. Remind students that people in this country vote for legislators to represent them. Ask the students if they know any of their legislators from the House of Representatives or Senate. The House and Senate work together as Congress to create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

2. Now that you know what you need to create ozone, list a few places that VOCs and NO_x 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 _____ NO_x

The Clean Air Act

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 "NO_x" 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 NO_x, 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 NO_x 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

NO_x

VOC

dust

water vapor

air pollution

allergens

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.



<p>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.</p>	<ul style="list-style-type: none"> ■ 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 (SO₂) – from power plants, which burn coal or other fuel to make electricity ■ VOCs – from smelly things like skunks, markers, gasoline and paint
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Activity

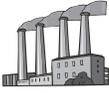
Let’s *act out* the Clean Air Act! For this clean air act we won’t be writing laws or going to Washington D.C., but we are going to investigate where two types of pollution come from and then act out how they form! These are the two pollutants that sometimes cause us problems here in Wisconsin – ozone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

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	 soccer ball
				 dust	

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

 dusty road	 pinwheels	 tailpipe	 factories	 toothbrush	 bird	 fire
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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?